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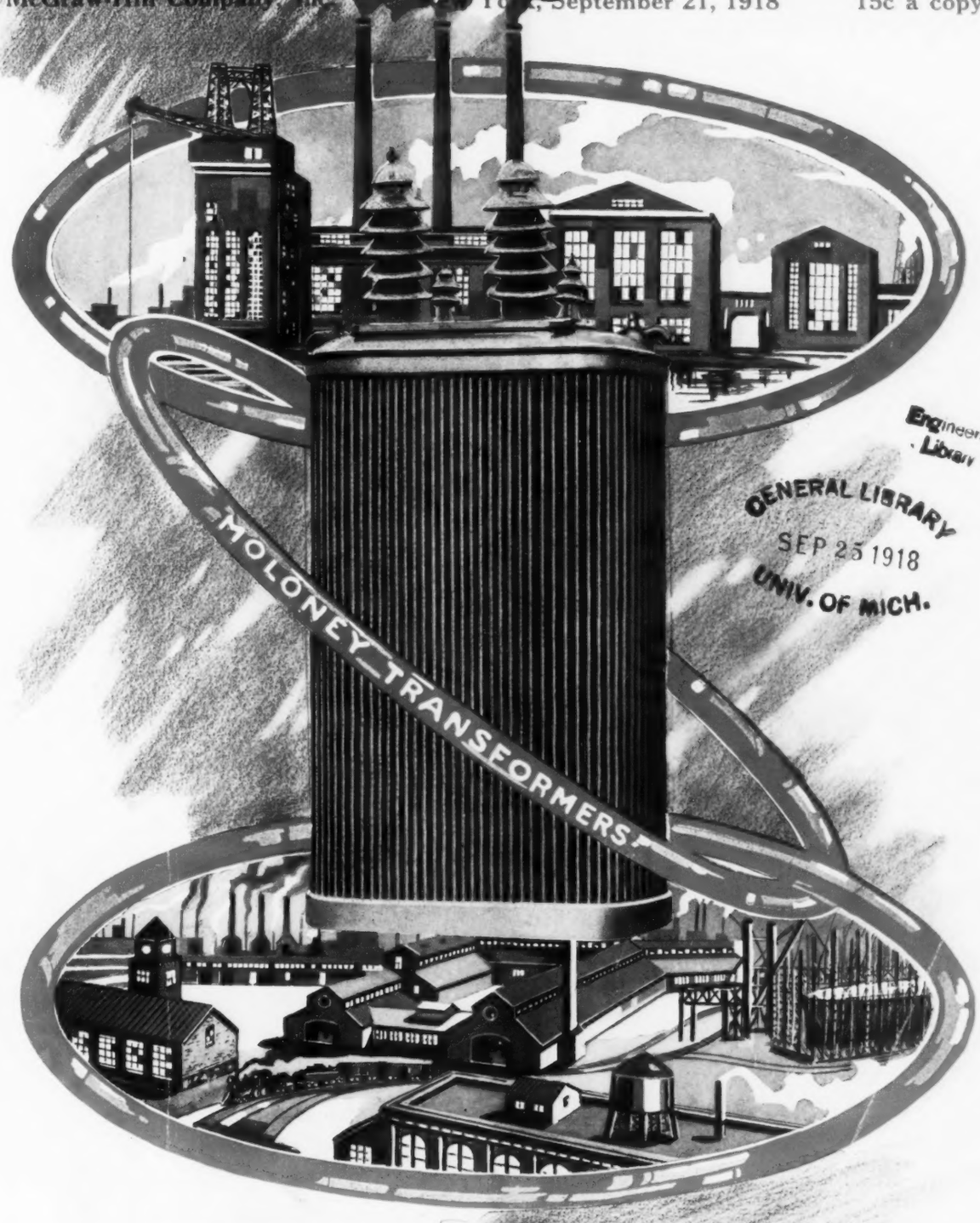

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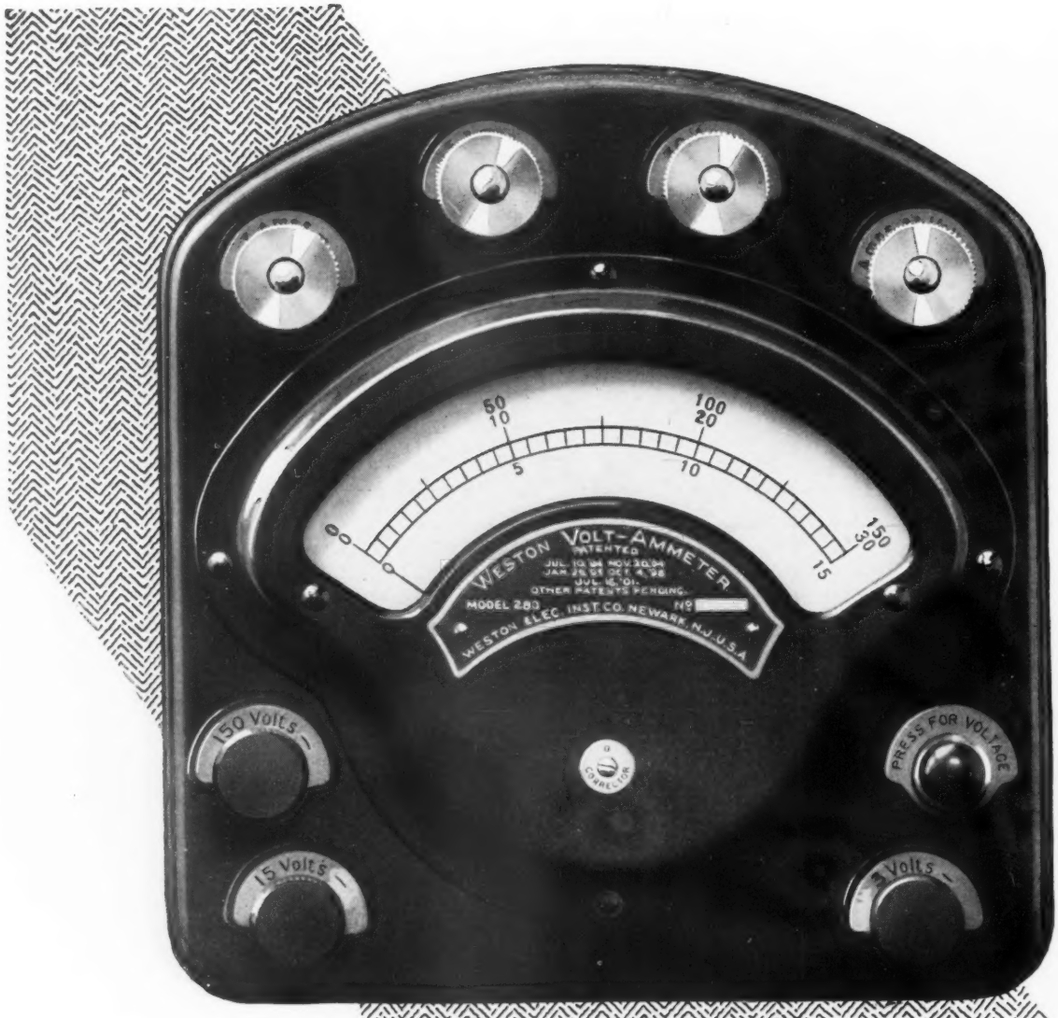

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Electrical World

F. M. FEIKER, *Editorial Director* W. H. ONKEN, JR., *Editor*

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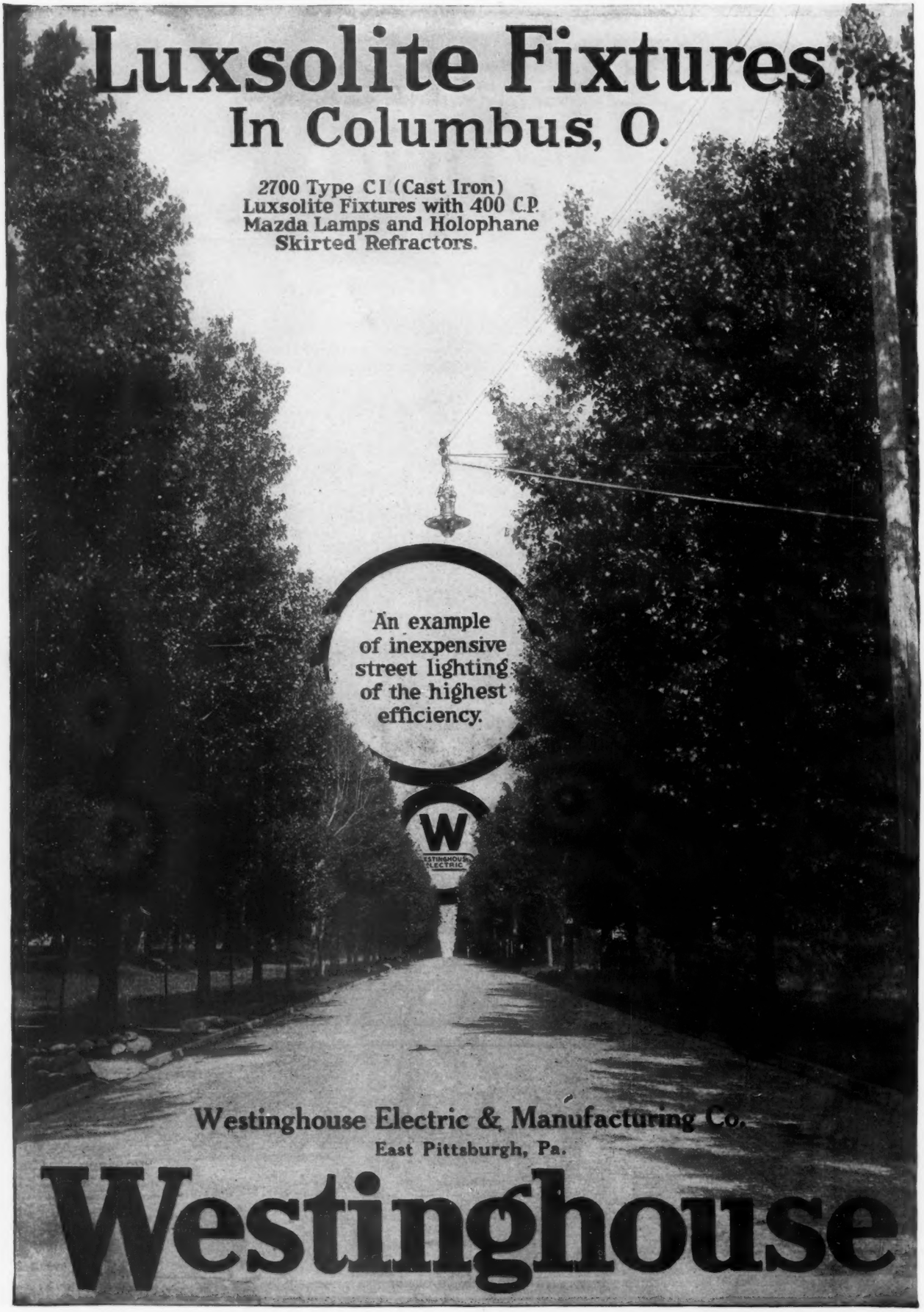

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Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

Volume 72 New York, Saturday, September 21, 1918 *Number* 12

War Man Power in the Industry

THE new call upon the man power of the nation applies to many individuals who are now rendering service of great value in the war work of essential branches of the electrical industry. It includes executives and workers who are highly useful in keeping the production of manufacturing plants and generating stations and the distribution facilities in the industry at top-notch efficiency. With the national need for complete control of the physically fit man power, the industry sympathizes fully. It is with the government in the large program for vigorous prosecution of the war to victory; it knows that the millions of our splendid troops will speed the restoration of righteous conditions in the world; it appreciates that sacrifices have to be made. The electrical industry will not stand selfishly alone demanding preferential consideration greater than that which is accorded to other industries whose output is of equal importance to the country in the emergency.

It appears, however, that coördination of the different points of view among the Washington authorities is most desirable. The War Department says rightly that it must have men, and of course it is entitled to the first call on all that it considers in the national interest should go to the front. The government Director General of Railroads on his part sends word to his subordinates to claim exemption for general officers and workers vitally needed to keep traffic moving, and we should not want to say that he is not right from his standpoint too, because supplies must be transported to seaports and thence to the fast-increasing armies overseas. But in order that the supplies may be moved they must first have been produced, and in that production the workers in the electrical industries have an indispensable function. The Shipping Board must keep its quota of labor for shipbuilding; coal mines and producers of foodstuffs must have workers and power, but electricity is a large factor in economical quantity output in all of those activities. In fact, there is not a single place in the war program where electrical apparatus and supplies and electrical energy do not enter to promote efficiency and economy, to increase production. The thing that causes concern, therefore, is not whether the government, seeking the best interests of the nation as a whole, shall decide that this man or that man is more useful as a soldier than in his normal work, but how the industry can maintain the required volume and quality of production if its labor situation is changed materially.

The ultimate decision as to the disposal of man power is with the Washington authorities, and the industry looks to them with confidence that their judgment as a whole will best serve the national interest. The specific acute problem that arises, however, when a manufacturer is devoting say 90 per cent of his activities to government work is one that he cannot solve without assistance. If his trained men, whether salaried executives or wage workers, are called for other service, his ability to produce government supplies is lessened. If the men who have done the work in the past are not there, the work cannot be done unless their places are filled by others capable of doing it as well. Part of the answer will be supplied by the use of women, part will undoubtedly be given by the exemption of men held indispensable, and perhaps it may even be assumed that the government will allot competent workers, in uniform or otherwise, to the vital basic industries. In any event, the question of men or women who will produce the necessary electrical apparatus, supplies and energy in unending streams for the support of the troops at the front is inseparable from the rest of the military problem.

The Call of Liberty

ARNOLD VON WINKELRIED was a Swiss hero outrivaled in popularity only by that other mountaineer, William Tell. His fame rests on the story that at a critical moment in the great battle of Sempach he rushed toward the Austrians and with outstretched arms gathered a number of their spears together against his breast, crying, "Make way for liberty!" By this means he opened a way through the hostile ranks for his fellow countrymen—though at the price of his own life. Less dramatic and hazardous but just as patriotic service can be rendered the cause of liberty by every man, woman and child in the United States. Not all may fight. Most of us must stay at home and do our share in keeping our men at the front supplied with food, clothing and the wherewithal to overcome the enemy. It requires money to do this—money to buy material and to pay for labor. The government is obliged to raise a large part of this money through bonds. Better securities never were issued because the United States guarantees the principal and pays the interest. It is a privilege to buy and an honor to keep these securities. Liberty calls for the fourth time, "Billions of dollars are needed and needed now." No American will ring off without answering the summons to buy. With this issue is a Liberty bond cartoon. You may serve your country first by displaying it in a conspicuous place and then by investing in the bonds yourself.

Electrical Power Supply at the Front

THE paper from our staff correspondent, Mr. Tomlin, on the electrical developments undertaken by the American Expeditionary Forces gives an exceedingly striking view of the energy and resourcefulness with which American engineers have dealt with a difficult situation. We have been very fortunate in the extremely able and efficient engineer force which our country has been able to place overseas. In planning, building or fighting it has always been ready to meet any emergency. When one considers that there is demand for 50,000 kw. or 60,000 kw. for the use of our forces in France even now, with the prospect of this being greatly increased in the near future, it will be seen that the electrical branch of the service is an important one. When the returns are all in the amount of building of docks and warehouses, factories and workshops which the American forces have accomplished in less than a year will rise to a stupendous aggregate. For all these purposes electric light and power are a fundamental necessity, and the sources from which they can be obtained furnish the first really difficult problem.

In so far as is possible the policy has been carried out of obtaining power from French central stations rather than by undertaking new constructions. So far as the capacity of these stations is adequate, electric supply merely means a running of transmission lines, which to our engineering forces is a comparatively trivial matter. They have built already between 130 and 140 miles of lines at 30,000 volts to 40,000 volts, to say nothing of the accompanying distributions. When the French stations prove to be short of capacity new equipment is added, when possible, before the installation of entirely new plants is undertaken. Conditions in the electrical industry in France make prompt supply of material by no means easy, but yet still manageable, when one considers the time of transport which has to be added to that of manufacture in getting machinery from home.

The technical board having matters in charge has proved to be very alert and efficient in dealing with the continual difficulties which face attempts at speedy work on a considerable scale. One of the most interesting features of the situation is the development of water powers where the conditions are reasonably favorable. Several steam-driven power stations have already been erected, and the water power is just coming under the hand of our forces. Half a dozen projects are under way involving the installation of a true outdoor type of generating station such as has been already described in our columns. These plants can be worked efficiently during the war and perhaps later developed into stations of more usual and conventional type, although we have a well-defined idea that if an outdoor station is well built in the first place there will be small need of elaborating it. Taken altogether, the electrical work accomplished and under way is of striking magnitude, and the projects undertaken have been put through with a speed and efficiency which is a credit to the service and to the great body of patriotic engineers who are working overseas to bring victory to the army of liberty.

Pound-Foolish Lighting Curtailment

WE NOTE with regret signs of another raid on electric lighting in the alleged interest of fuel conservation. The time has come to speak plainly on this matter in order that the public may understand just what the real effect of lighting curtailment is likely to be. It has been repeatedly shown in these columns that the actual amount of fuel used for the production of electric light is relatively very small, amounting to not much more than 2 per cent of the total fuel consumption of the country. It has also been pointed out that on the whole this fuel is efficiently utilized, and that the benefits of its consumption are shared by a very large number of people who should not be deprived of its use for trivial reasons. As we have many times reiterated, the lighting industry as a business is not seriously worried about the matter except in so far as it desires to protect users of electric light from unnecessary infringement of their privileges. The call for electrical energy is so great and increasing so rapidly that any practical reduction in the amount of lighting will be rapidly made up by the growth of other uses for energy.

If one looks over the field of electric lighting it will be seen, as the published data show, that roughly two-thirds of the entire lighting output is for industrial, commercial and domestic uses, in not far from equal proportions at the present time. It is well known to engineers that the first class of service cannot be materially reduced without grave injury to industrial efficiency. Most plants are under-lighted rather than over-lighted, and the saving which can be made without injury to the output is in the improvement of utilization, which should all the time and everywhere be encouraged. The time has come when any industry which in the exigency of war should be permitted to operate at all by artificial light should be free to light its works so as to secure the best utilization of labor and material. We have been suspiciously tender of non-essential industries in this country up to the present time, and apparently are still disposed to cherish them even at the expense of those which are necessary. It is well within the bounds of fact to say that industrial lighting cannot be curtailed to any material extent, save in so far as needless industries are in part or in whole eliminated.

With respect to commercial lighting a somewhat similar situation exists. If it be really a case of national necessity to save fuel at the expense of light, and the powers that be are willing to take the responsibility of shutting down commercial establishments for this purpose, so be it; the responsibility rests upon those who issue the orders. The only reduction which can be made while retaining shops in operation is a diminution in the amount of display lighting which belongs to advertising rather than to necessity. The domestic user of light, owing to stimulus of rising prices and to daylight saving, has already cut his consumption very considerably and from motives of personal economy will continue to do so. A reduction in the amount of energy allotted to domestic supply would fall most heavily on the electrical appliances, and the disuse of these will, so far as fuel conservation is concerned, produce ex-

actly the wrong effect. If people stop using electric irons and the like, they will not abandon ironing, but will light up exceedingly wasteful stoves and ranges to accomplish the same work at a considerable increase in fuel consumption. Street lighting is, save for occasional "white way" efforts, at a point where any material diminution would mean the approval of the Highwaymen's Protective Association and the Burglars' Union more than of the long-suffering public. There remain divers minor departments of electric lighting in which petty economies might be made. The proprietors of "movies" would doubtless be glad to see restrictions on theater lighting; restaurants and cafés could be pinched down materially if the menus were printed in larger type for the assistance of the patrons; churches could be reduced to more than the usual gloom, and halls and corridors could be left in semi-darkness. All told, the practicable reductions in the use of electric light without grave inconvenience and some danger to the public are wretchedly small.

But the phase of the matter to which we want to call the vigorous attention of the enduring public is that the conspicuous quality of semi-darkness is no reason for enforcing it unless there is to be a considerable and genuine saving accomplished. It is all very well to prattle about the "psychological effect" of such economies, but in the long run that effect is going to react seriously against those who are responsible to the public for real rather than apparent economies. There has been far too much in the way of gags for the gallery passed out under the name of conservation. Most Americans are perfectly willing to suffer great inconvenience if necessary for the carrying on of the war, but one cannot fool all of them all the time, as Lincoln wisely remarked. The government has the right, the power and the duty to seize without ceremony all fuel that is necessary for carrying on the war efficiently. If its representatives, having this power, fail to commandeer fuel sufficient for these imperative needs, they face a responsibility dangerously near to treason, but until all industries not necessary to the war are curtailed with a rigorous hand, even if need be to the point of extinction, it ill becomes the authorities to indulge in cheap and noisy buncombe to secure inconsequential results. Frankly, we regard the hue and cry about lighting curtailment as a species of smoke barrage concealing the emptiness of the efforts which retreat from the plain duty of turning American industries into rigorously necessary work, a duty which our Allies have long since accepted without hesitation.

Fourth Call—Are You Ready?

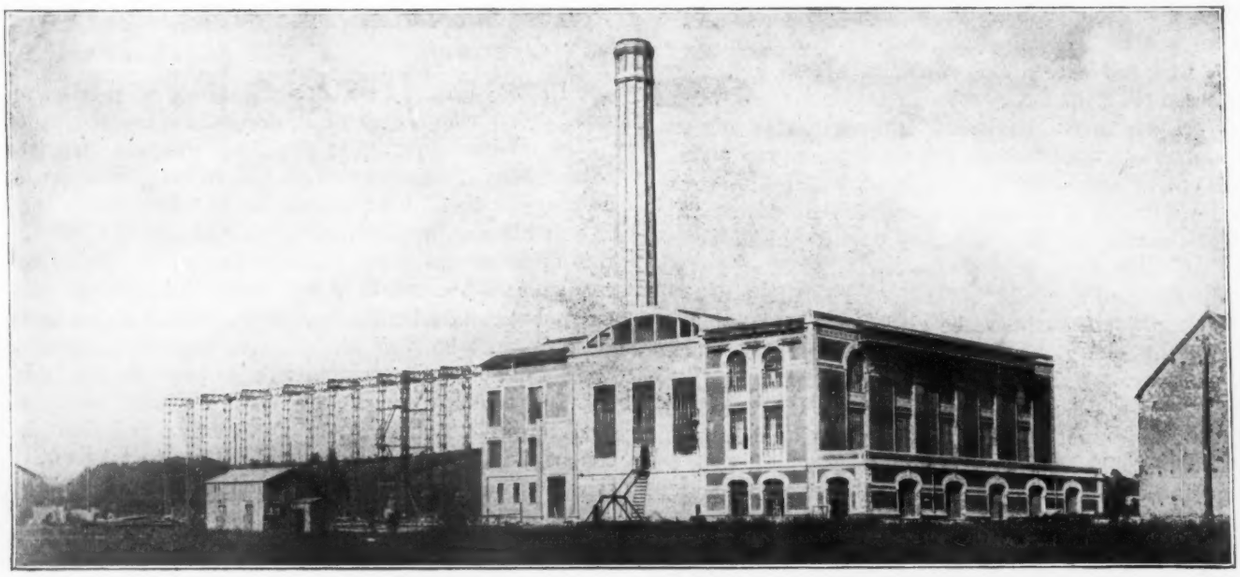
Female Substation Operators

A PEEP into the Roslindale substation of the Boston Edison company nowadays would give a grandmother of the late nineties one of the greatest surprises of her life. Even the central-station man, accustomed to progress in all branches of the industry, is inclined to rub his eyes a bit when he sees an installation like this operated entirely by young women of trim, alert competence, who not only can speak the electrical language but can deal with concrete apparatus with a skillful assurance born of an intensive training and practice. That a young woman with no previous electrical knowledge can be transformed into a reliable assistant operator in the short space of a month, and that she can be fitted in two months' total time to take entire charge of an operating shift, is little less than amazing; but it is one more evidence of American adaptability when confronted with a really acute problem.

Young women have been successfully trained for central-station service in England during the last few years, and the Boston company of course knew this in establishing its training plan for female substation operators. At the same time, its program was largely experimental, and there was little time in which to theorize as to the fitness of American girls for such work and the best methods of intensive instruction. This is the first instance in America of a substation taken over for exclusive operation by women, and it is significant that the Boston company is going ahead rapidly with its classes of girls in training to take the places of male operators as fast as conditions may require. There appears to be no difficulty in obtaining applicants of desirable type for the service required; the short but concentrated instruction given appears to be absorbed with readiness and even enthusiasm, and the actual handling of the installation in routine and emergency duty compares very favorably indeed with the work of men attendants. By selecting applicants from women having well-poised nerves and self-control, a reasonable measure of physical strength and an intelligent interest in this new and responsible work as the training unfolds its scope, the company has supplied itself with operators who are not stampeded by the opening of a high-tension switch under an overload or by the burning out of this or that piece of auxiliary apparatus by lightning. The "housekeeping" side of substation service, including the reading of instruments, preparation of log-sheet records and maintenance of cleanliness, is looked after with traditional pride and faithfulness, and the effect of the work upon the health of the operators seems to be excellent.

The Coming Issues

MORE employers of power-plant labor are beginning to realize that improvement of plant economy depends as much, if not more, on the training and handling of the labor as on the equipment used. Supplementing what has already been said in the ELECTRICAL WORLD, there will be another article on "How Best to Educate Power-Plant Operators." The second installment of the article on conductor heating will also appear in an early issue. One means of economy that has not been talked much about is prolonging the life of line poles. This subject will be considered from the viewpoint of arresting decay that has already started. The economical loading of transformers, the construction of war-time outdoor substations and industrial applications of electricity will also be discussed. Besides data on the power consumption, speed and efficacy of spot welding, some very instructive suggestions will be given on maintaining induction motors and speeding production with graphic meters.



15,000-KW. STEAM GENERATING STATION CONSTRUCTED EXCLUSIVELY FOR AMERICAN EXPEDITIONARY FORCES

Electrical Developments for American Army

Present Plans for the Troops in France Provide for 50,000 Kw.—Technical Board, Newly Created, Controls Supplies and Co-ordinates Work of Design and Construction—Electrical Machinery Difficult to Get.

BY R. K. TOMLIN, JR.
Staff Correspondent in France

"WHAT are the electric power requirements of the American Expeditionary Forces and what is being done to meet them?"

This is, in substance, the question I put to a captain of engineers at the headquarters of our Services of Supply in France who, since giving up his position in civil life with the Commonwealth Edison Company of Chicago, has been in responsible charge of electrical matters for our armies overseas. As a result of this interview it is possible to discuss in a general way the situation with which our electrical engineers in the American Expeditionary Forces are dealing.

It should be understood, however, that there is nothing of finality in what follows. Conditions change rapidly. One day an electrical engineer officer may be completing plans for the development of a certain amount of power at a certain place; the next week he may be faced with the problem of doubling the output originally contemplated. It generally works this way, that is, increase rather than decrease in the amount of work to be done. Then, too, sites where no provision of power was ever anticipated may suddenly become important centers of activity at which electric installations must be made or to which transmission lines must be built. It is nothing new for a 10,000-bed hospital project to spring up almost overnight.

Coupled with these conditions of uncertainty and change—conditions inherent in the engineering work of war as distinguished from that of peace—are others which make the job of the electrical engineer anything but a sinecure. The chief of these is the scarcity of electrical material and equipment available for quick delivery. It is well to recollect that we are working in a country that has seen four years of war. Industry has been mobilized. Electrical equipment of all sorts which was of use to the Allied armies early in the campaign has long since been rounded up and placed in service, leaving little new stock on hand for the man who arrives upon the scene three years or more after hostilities commenced.

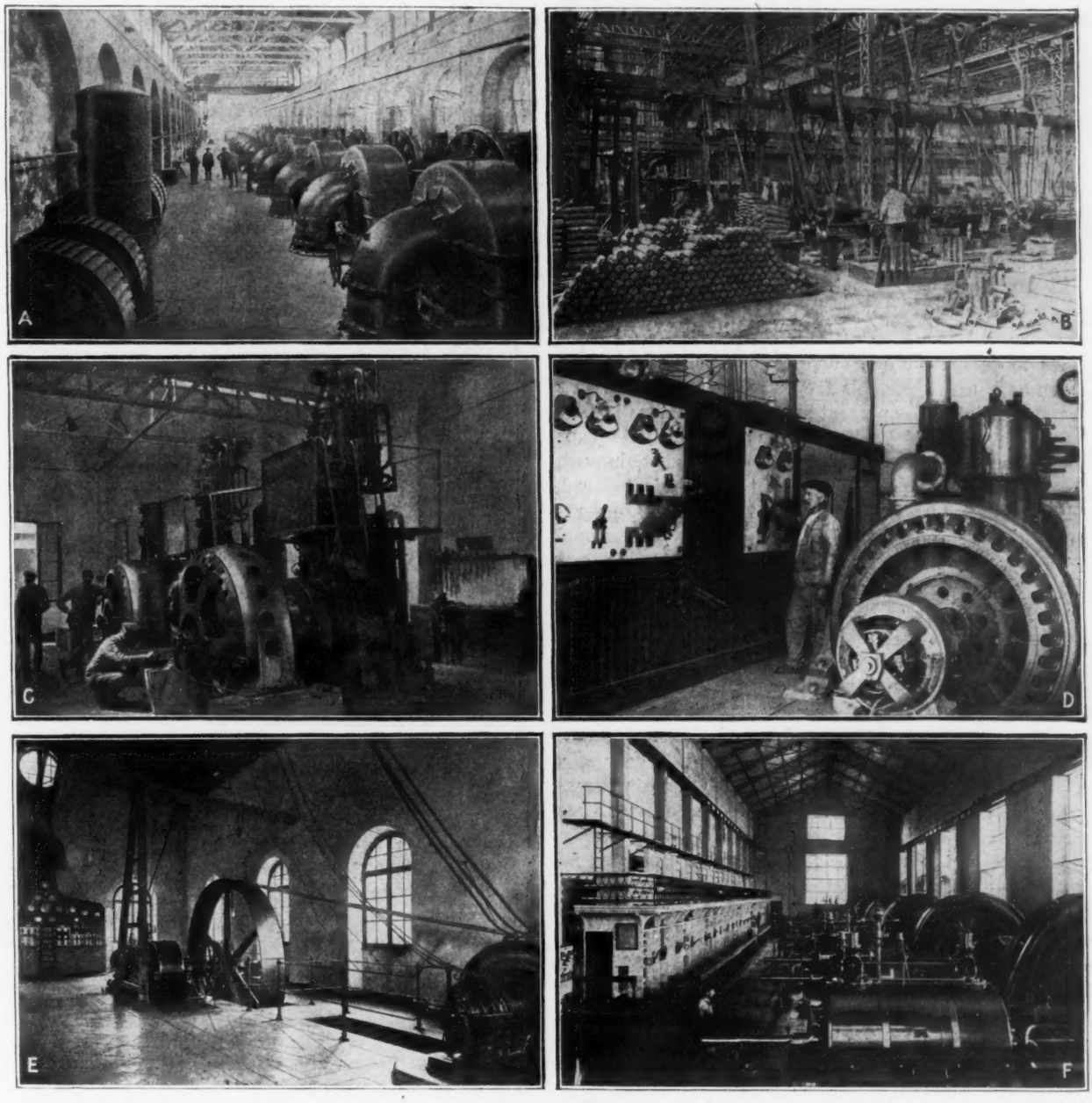
"My best guess as to the electric power demands of the American forces at the present time in France," said one of my informants, "is from 50,000 kw. to 60,000 kw. What the future will bring forth no one can tell. Certainly we shall have to be prepared to meet additional requirements. Strung along between the seacoast and the front are scores of places which are calling upon us to provide electricity for lighting and for the operation of machinery. In the first category come the hospitals, many of them equivalent to fair-sized towns. Some are already built; many are now under construction; still more are contemplated. They present no complicated problem for the electrical engineer. The hospitals generally mean merely interior wiring, for frequently the sites are within reach of existing central stations.

More difficult situations from the point of view of the engineer who is called upon to furnish electric power are presented at such installations as repair shops for mechanical equipment and ordnance, docks and refrigerating plants. There are also aviation production centers containing large numbers of machine tools requiring power for their operation. In France to-day there are thousands of American army motor trucks, and their repair centers demand the installation of power plants. Then, too, there are the several

storage and supply depots where the lighting problem is no small matter. Our water supply service is engaged upon many projects which call for the furnishing of electric power for pumping. It is apparent, therefore, that the demands made for electricity are extremely varied. Another factor which adds difficulty to the work is that power requirements must be met at many widely scattered points. It is not a question of equipping and putting into operation one or two

undertaken. The fuel situation demands careful economy of coal, and transportation conditions likewise make it necessary to conserve freight cars. Any large scale new central-station construction by the American army would necessarily involve more railroad track, more cars and more fuel.

Realizing fully the importance of these factors, our electrical engineers, when called upon to furnish power at some point, first make an investigation to see whether



GENERATING ROOMS AND A MUNITION WORKSHOP IN FRENCH GOVERNMENT PLANTS (FROM OFFICIAL FRENCH PHOTOGRAPHS)

big central stations, but rather of providing numerous segregated plants.

As a general policy governing the operations of the Technical Board and the electrical division of the Services of Supply, it has been considered best, wherever possible, to make additions to existing French central stations rather than to build new ones of our own, although a certain amount of new work has been

some existing French plant cannot be enlarged to do the work. Under present conditions, I was told, the policy is wherever possible to put in additional boilers, generators and transmission lines at a French power station rather than to embark upon new projects.

Sometimes the building of transmission lines from an existing station is the only new work required. It is true that the normal commercial load on many

French central stations has been greatly reduced since the outbreak of war, owing to restrictions in the use of electricity for lighting and for private enterprises of all sorts, but this reduction is more than compensated for by the increased demand of the war factories. The French stations are very carefully mobilized, and a close surveillance is kept over the sale of electricity. French power-plant operators cannot secure fuel except with the approval of a bureau of the Ministère de l'Armement, and not a kilowatt-hour can be delivered without a written authorization.

Another reason for making use of existing central stations, either in their present condition or enlarged, is the difficulty of securing skilled operators. Even when enlarged, these plants can be run by adding a few additional members to the force already on the job, which is, of course, a much simpler proposition than building a new plant and training a new operating crew. At present there is a great shortage of skilled labor available for central plant operation. Several large plants are now operated exclusively by women who work on heavy repairs and even fire boilers.

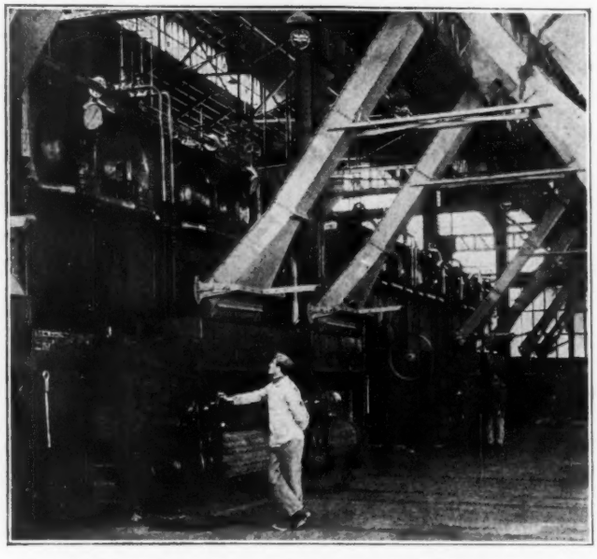
PURCHASES OF FRENCH EQUIPMENT

As to equipment and supplies, our policy is to purchase as much as possible from the French. Deliveries from America under present shipping conditions involve uncertainty and delay. To provide and coördinate plans for projects and the purchasing of electrical equipment, there was created some time ago the Technical Board, with headquarters in Paris. On this board are serving electrical engineers of well-known professional standing. To them demands from the field come, and it is their duty to find out where the machinery can be secured most quickly. At the present time there is a decided shortage in transformers and the various miscellaneous supplies urgently needed in the electrical work of the American Expeditionary Forces.

There is no comparison between the situation here and the one affecting the purchase of electrical equipment in normal times in the United States. The supply of stock material in the plants of French manufacturers has long since been exhausted, and at the present time raw materials can be secured by them only after a requisition has been approved by the proper governmental authorities. Practically everything must be built to order. The obvious result of this situation is delay in delivery. A manufacturer must wait until he receives a specific government-approved order for electrical equipment for use in the American army, or, for that matter, elsewhere, before he can commence manufacture. Under present conditions the manufacture of a transformer, for example, is not a matter of merely a few weeks but rather of several months.

Assume, for example, that a French manufacturer of electrical material receives an order for a generator. Before he can take any action he must submit to the Ministère de l'Armement a bill of the raw materials required. This bill of raw materials and the purpose for which the machine is required must then be investigated. If the order is considered justified from the point of view of the national defense, it is approved and goes back to the manufacturer, who is then permitted to secure his raw material and commence manufacture. This recital of the various steps which must be taken before a transformer—or, in fact, any other piece of electrical machinery—can be delivered on the job for use will serve to indicate the true conditions which our electrical engineers are facing in their effort to meet the demands for power in the areas occupied by the American Expeditionary Forces. The minimum time for building transformers of, say 150 kw. rating is about four months. Raw materials in the plants of electrical companies are placed on schedule for filling orders months in advance. A specific case will serve to illustrate. One central station sent to a manufacturer in June an order for a transformer urgently needed but which could not possibly be built before December.

In the matter of insulators the shortage is still worse. Much of the clay used in the manufacture of insulators comes from England, and deliveries have fallen off considerably. Special arrangements with manufacturers, providing for coal and clay, however, are now under way.



FURNACE ROOM IN FRENCH WAR PLANT (FROM OFFICIAL FRENCH PHOTOGRAPH)

Referring to the matter of power-plant enlargement, the captain of the Engineer Corps explained to me that the French central stations at present have little money for extensions. No equivalent of the American "new-business" department exists in France. Such enlargements as are being made for use by the American Expeditionary Forces are being paid for by the United States. This same thing applies to transmission-line construction. Our policy is to adopt overhead construction entirely in connection with the distribution of electrical energy. We are paying for all the lines we build, and the understanding with the French government is that they are the property of the United States. When the war is over it will be possible for us to recover the material we have put into this work or, through some board of appraisal, negotiate with the French for its purchase if desired Any policy which would have included an extensive amount of underground work would, it is clear, have resulted in various complications as to the final disposal of the material.

As for transmission lines, we have already built, or have planned to build, 220 km.—equal to about 137 miles. As a general rule, we use on these lines a voltage of 30,000. The highest voltage employed is 40,000. At the time of my visit to our Services of Supply transmission lines were under construction to supply four hospital sites, supply depots, an ordnance repair shop and special services such as gas manufacture.

The situation affecting the installation of electric power plants and transmission lines for the American armies is different from that of the French. This difference is accounted for, in some measure, by the temperament and customs of the two peoples. One enters a French "caserne," or barracks, and there is not an electric light to be seen. The men get along with lamps and candles. In marked contrast are the American barracks, most of which in the zones back from the immediate fighting fronts are wired and equipped with electric lamps.

THE TECHNICAL BOARD

At the present time our electric service has trained men stationed at the various important centers of France where American troops are to be found. These men report to the electrical department at the Services of Supply, where construction and operation of the various field projects are centralized. This department, as noted before, works in very close coöperation with the Technical Board in Paris in all matters involving new projects and, particularly, in the purchase and delivery of machines and supplies.

The Technical Board, in so far as electrical matters are concerned, is the outgrowth of special conditions affecting the use of electric power by the American army in France. Early this year it became apparent that some agency would have to be created to handle the broad administrative problems involved, to determine policies, to pass upon and coördinate designs for individual installations, and to act in the dual capacity of consulting engineers and liaison officers in all situations of official contact between French and American interests. Obviously, the character of the work mapped out for the Technical Board demanded for its personnel men of exceptional qualifications, men combining a thorough understanding of the technical features of the electric generation and distribution with vision, tact and proved administrative capacity. Here was a place, of all others, where outgrown military usages and practices and the legacy of old army traditions, ill-adapted to the large-scale business and engineering problems of war as it is carried on to-day, had to be relegated at once to the scrap heap. The job of the Technical Board, which began its work last March, is to secure machinery, see that the electric power demands of the American forces at widely scattered centers in France are met—and met just as speedily as business methods can achieve this end—and, what is particularly important, maintain a complete and amicable understanding with the French government, through its Ministère de l'Armement, on all questions of electric generation and distribution.

This latter phase of the situation is one of big proportions. While our engineers are working at present to supply the immediate needs of the American Expeditionary Forces, it is absolutely essential now to look ahead to the time when a declaration of peace will release for commercial use the vast number of sources of electric power which have been or are being developed to-day strictly for the business of waging war.

In central France there are being built for American army use more than a score of so-called "usines"—manufacturing plants of one sort or another—required for the production or repair of war material. All of these plants call for electric power installations. The situation, therefore, is one which involves planning in order that present enterprises may be adapted to after-the-war conditions. Upon this after-the-war objective, as well as the immediate business of the armies, the Technical Board is focusing its vision. It is working in close coöperation with the French authorities, and our engineers in America may rest assured that in matters of electric power development in France our Technical Board is, in reality, constructing a sort of double-barreled gun—one barrel for the immediate use in war work, and the other for the industrial offensive which will begin just as soon as the artillery at the front is silent.

WATER-POWER DEVELOPMENT

In addition to several steam-electric power stations which have been built by American labor in France, we have under consideration half a dozen projects for the utilization of water power by means of the "out-door type" of electric generating station described in the ELECTRICAL WORLD of Jan. 19, 1918, by Alexander C. Clogher and Victor F. Hammel. In fact, it has been largely through the instrumentality of this article, I am told, that the French authorities have become convinced of the desirability of immediately beginning work on stations of this sort. The design provides for the utmost simplicity in construction—merely a water-wheel and generator on substantial foundations housed under a rough shed of some sort. However, the idea is ultimately to make these hydroelectric plants permanent. They will be left in their rough state for the duration of the war and will then be inclosed in a permanent masonry structure designed by French architects to meet the requirements as to exterior appearance, which are a matter of more concern over here than in the United States. Hydroelectric plants of this type now under consideration are rated at from 2000 kw. to 8000 kw. and will operate under moderate heads. For the initiative in introducing this "out-door" type of unit the Technical Board is directly responsible.

In contrast to these installations is another hydroelectric development of 9000 kw. which has been partially completed by the French. It is probable that the American forces will take over this work, finish it and operate the completed plant. In so far as possible the American-built and French-built systems of electric power transmission will be interconnected.

In view of present shipping conditions, where tonnage is being reserved for fighting men and their food rather than for other supplies, the Technical Board is endeavoring to procure practically all electrical equipment in France. There are, it was explained to me, two good reasons for this policy. In the first

place, shipments of American-made products needed for power development are difficult, if not impossible, to secure. In the second place, the French equipment, built to conform to current French practice, is in many cases practically obligatory, especially in view of the fact that it must be used not only for present military needs but also for commercial service after the war.

On many details of electrical power development and transmission French and American practices are at variance, and certain American equipment would be practically useless over here. The French employ almost no direct current, the almost universal preference being for 50-cycle, three-phase currents. American equipment of either 60 or 25 cycles cannot be employed. Then, too, the distributing voltage in France is 3000 volts or 5000 volts; the American standard of 2300 volts does not exist in France.

GLASS INSULATORS

I have referred before to the shortage in clay for insulators. The French have succeeded in producing a glass insulator suitable for service on 35,000-volt lines. For the manufacture of these insulators the French have developed skilled artisans, and the quality of glass, I was informed, is far better than anything which has been produced on a commercial scale in the United States. In fact, the electrical engineer who spoke to me about them was so well impressed with their quality that he said he would not hesitate to use French-made glass insulators on lines carrying voltages of 50,000 or even 60,000.

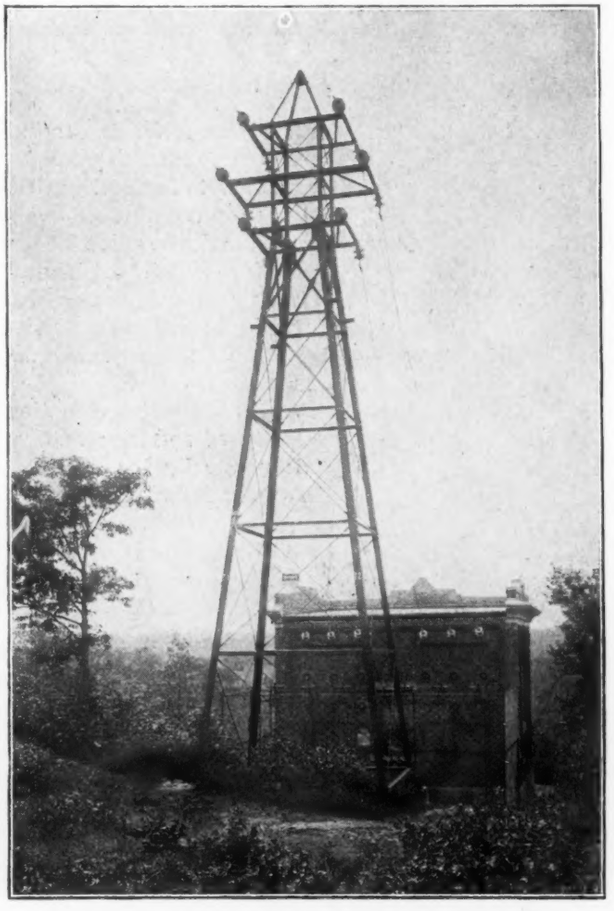
There is at present a pronounced shortage in the American Expeditionary Forces of electrical engineers available for the work immediately in hand. This condition has loaded upon the shoulders of the men now assigned to electrical duties a very heavy burden. At the present writing one region in France has been selected where four steam generating stations and one hydroelectric station are under construction by American forces aggregating 38,000 kw. in rating. All of these stations are to be linked into a single system with a voltage of 30,000, which will later be raised to 65,000 volts.

While the work of electric power development for the army in France is complicated by the shortage of machinery and equipment and other situations not encountered in peace-time operations, there are compensating advantages. The chief of these is the thorough way in which the French Ministère de l'Armement has mobilized the central stations, controlled the supply of fuel and regulated the distribution of energy. Not a kilowatt of electric energy can be produced without the authority of the Ministère de l'Armement. On all matters electrical its word is law. It is vested with powers which greatly simplify the putting into effect of such projects as are required for the uses of the American Expeditionary Forces. Close coöperation with the French, therefore, is accomplishing two big objects. First, it is giving us the necessary help in speedily carrying out the projects immediately demanded by military requirements, and, second, it is laying the foundations for an industrial renaissance in which electric power will assume a place in France never dreamed of before the war.

SUBSTANTIAL SAVING IS MADE BY INTERCONNECTION

Fifty Thousand Dollars' Worth of Coal Is Saved in the First Year's Operation of Massachusetts Transmission Tie Line

Six thousand three hundred and eighty-three tons of coal were saved by the first year's operation of the Salem-Malden-Revere transmission tie line of the Eastern Massachusetts Electric Company through taking advantage of the diversity factors in the central-station system in the above cities. This line, which has been described in the ELECTRICAL WORLD, consists of two circuits rated at 5000 kw. each, carried in part on steel towers and in part underground and operated at 22,000 volts. It connects the largest plant of Charles H. Tenney & Company in eastern Massachusetts, at



VIEW ON EASTERN MASSACHUSETTS TIE LINE

Salem, with plants operated by the same syndicate in Malden and Revere, and enables the two latter stations to be shut down at times when sufficient reserve capacity is available in Salem.

The rating of the Salem station is 17,000 kw., and the maximum load in 1917 was 11,250 kw. Of the latter, 4500 kw. was taken by the Naumkeag Steam Cotton Company's plant in Salem and 4500 kw. by the tie line. The fuel saved the first year through the tie line, with its provision for the economic balance of loads, exceeds $50,000 in value, and the total cost of the tie line with terminal houses and equipment was about $305,000.

The Outdoor Substation in War Service

Through Its Use the Sudden Demands for Power to Supply War Industries Have Been Promptly Met with a Resulting Conservation of Material and Labor—Outdoor Stations Have Come to Stay

BY E. B. MEYER
Assistant to Chief Engineer, Public Service Electric Company of New Jersey

ON ACCOUNT of the rapidity with which most of the materials covered by war contracts must be delivered, industrial companies have found that the building of isolated plants is out of the question, not only because of the time necessary for erection, but because of the low rates and excellent service furnished by utility companies. As a result central-station companies have had to make numerous extensions to their plants to take care of the demands imposed upon them by the war industries. The difficulty of obtaining material on short-time delivery, the speed with which the installations have to be made at the present time, and the need of conserving funds, all make it imperative that all central-station equipment be utilized to the best advantage. With this idea in mind, many central-station companies have adopted the practice of providing outdoor substations for serving the various war industries which are depending upon them for power.

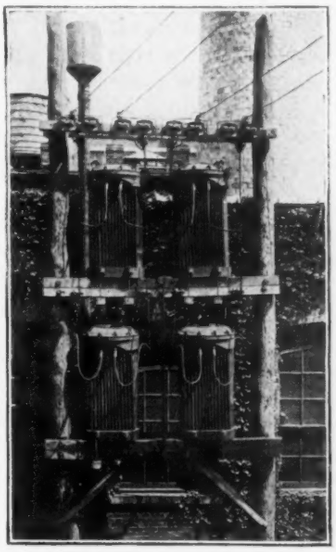


FIG. 1—WOODEN STRUCTURE SUPPORTING OUTDOOR TRANSFORMER ON POLES

The development of electrical apparatus and equipment has been such in recent years that at the present time it need no longer be operated indoors. The use of outdoor substations, therefore, has been one of the means of hastening the end of the war in that it is no longer necessary to provide costly fireproof structures for the housing of electrical equipment. Outdoor installations can be made at a greatly reduced cost and the saving in both labor and material for use in connection with other work having a more direct bearing on the war is therefore an item which should not be overlooked.

For small outputs and comparatively low voltages the transformers are usually hung from a substantial pole directly underneath the transmission line (Fig. 1), the switching equipment being mounted on cross-arms between the line and the transformer, and the transmission line carried on the top of the pole. Transformers of larger output or higher voltages are mounted on platforms, sometimes arranged on steel towers (Fig. 2), and at other times on wooden structures supported between two or more poles, while the switching equipment is usually carried immediately above the transformer. For the largest outdoor substations the transformers are mounted on guarded concrete platforms (Fig. 3), while the switching equipment and transmission lines are carried on steel towers of strong construction.

Substations of the portable type, with the apparatus mounted on wagons, floats or railway cars, are particularly adapted for breakdown auxiliary service, temporary peak loads, construction work or any of the other numerous war-time demands made upon the central-station companies.

It was originally supposed that the outdoor station created a greater hazard to the public than one in which all the equipment is housed, but this fear is groundless since with the property inclosed by a substantial fence the danger to the public is eliminated. With the outdoor substation there should always be less danger from fire, provided proper precautions are taken against the accumulation of inflammable material on the property.

REQUIREMENTS OF AN OUTDOOR STATION

In the design of an outdoor substation it is desirable that the installation be as neat and compact as possible. Usually elaborate switching equipment is not necessary to provide immunity from interruption as in most cases interruptions are so infrequent that the cost of providing duplicate and expensive equipment is not warranted. The outdoor installation, as well as all

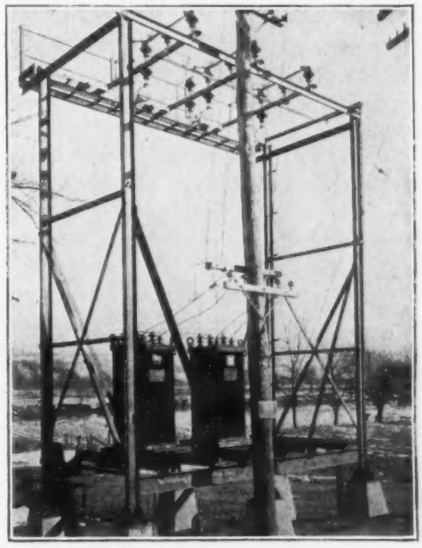


FIG. 2—HIGH-VOLTAGE TRANSFORMER MOUNTED ON STEEL STRUCTURE WITH TRANSMISSION LINE AND SWITCHING EQUIPMENT ABOVE

other forms of high-tension installations, should be so arranged as to make the operation as simple as possible and at the same time provide ample protection to the operators and repair crews.

In a number of outdoor substations steel structures

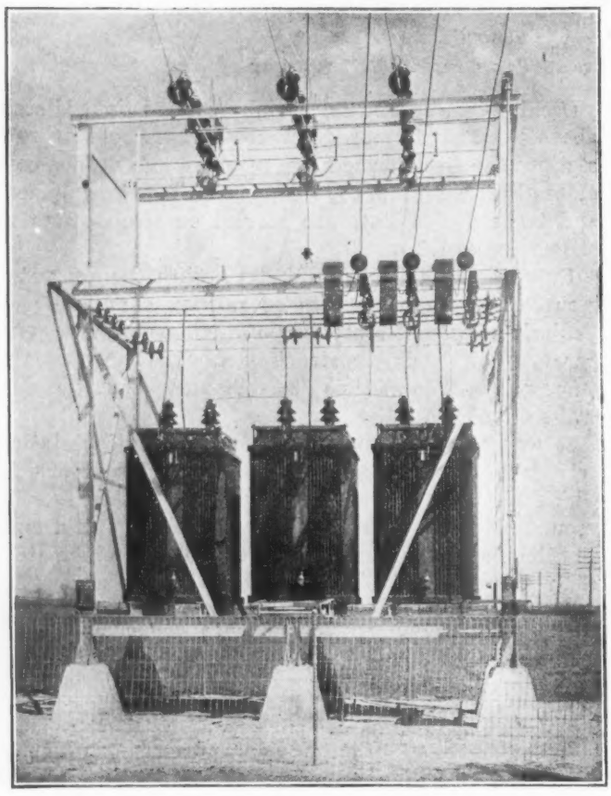


FIG. 3—OUTDOOR TRANSFORMERS MOUNTED ON GUARDED CONCRETE AND STEEL PIERS

are used for mounting the buses, disconnecting switches and other equipment. The difficulty at this time of obtaining delivery on structural steel and the advisability of conserving this material for shipbuilding and other important war needs has made it necessary to look about for some other type of construction. Heavy wood poles and timber construction may be used to good advantage and at the same time reduce the cost considerably. In Fig. 4 is shown an outdoor installation for 26,000-volt operation in which all of the equipment is mounted on a wood structure. The main electrical connections of this installation are shown in Fig. 5.

In Fig. 6 is shown what might be called a semi-outdoor installation. This substation is located in a factory district where real estate was readily obtainable at low cost and where it was contemplated to change the transmission voltage from 13,200 to 26,400 volts, which change necessitated an entire new substation design. The water-cooled transformers, high-tension oil switches, aluminum-cell arresters and buses are installed outdoors. The automatic induction feeder regulators, switchboard, 2400-volt double bus and 2400-volt electrically operated oil switches are installed indoors. The arrangement selected necessitated a building approximately 25 ft. (7.6 m.) wide, whereas a design with all of the equipment installed indoors would have increased the width to approximately 50 ft. (15.2 m.) in order to obtain proper clearances for 26,400-volt operation. A longitudinal section of the building and outdoor equipment is shown in Fig. 7. From this substation to the customer there are three 250,000-circ. mil. cables feeding a common bus. As automatic regulation was required on these feeders, it was necessary to mechanically interlock the three single-phase regulators, one of which was used on each phase.

The outdoor arrangement worked out very satisfactorily from both first-cost and operating standpoints and it has resulted in the adoption of this particular design in other locations. Between the transformers and the outdoor installation running parallel to the substation wall is a track which leads to a small house in which transformers may be repaired. The repair house is provided with a hoist so that the transformer coils may be readily removed and the casing placed outdoors while repairs are being made to the winding without interference from bad weather. It was because this substation is situated in a section remote from other properties of the central-station company that it was thought advisable to provide ready means for repairs.

Where outdoor equipments are built adjacent to existing stations, it is not necessary to provide a separate repair house, as in such installations cranes and other facilities are usually at hand to take care of emergency repairs. An installation of this kind is shown in Fig. 8. Where repairs are necessary, the transformer is moved into the station building either by means of a track or skids and all work carried on indoors where overhead cranes are provided.

STORAGE OF OIL DURING TRANSFORMER REPAIR

In installations where large capacity oil and water-cooled transformers are used it is sometimes necessary

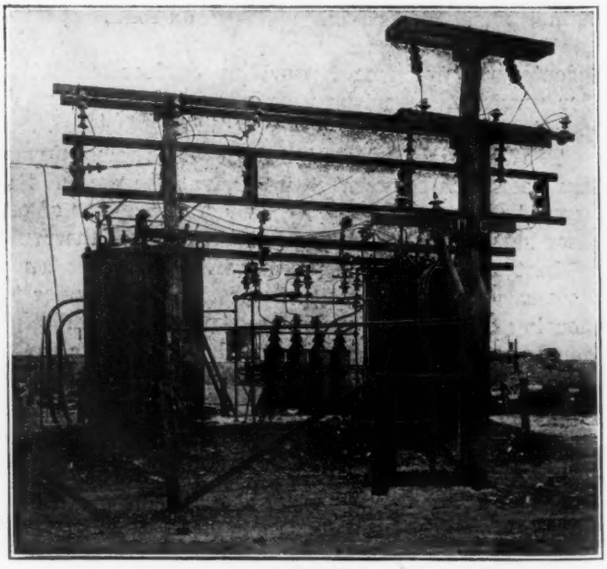


FIG. 4—INEXPENSIVE HIGH-VOLTAGE OUTDOOR INSTALLATION

to provide a tank for storing the oil from transformers under repair. Oil tanks are usually built of boiler plate, but as this class of material is one of those on the list which must be conserved for war purposes, it is neces-

sary to provide some other form of construction as a substitute. One large central-station company where a number of high-capacity oil and water-cooled transformers are used has experimented with a concrete tank for oil storage. In the particular installation in question a concrete tank 13 ft. by 6 ft. by 6 ft. (4 m. by1.8 m. by 1.8 m.) was built adjacent to the outdoor installations and so arranged that the oil can be drained from the transformers directly into the tank. The tank is built with a mixture of one part cement, two parts sand and four parts broken stone and reinforced rods to make a structure of sufficient strength to withstand the oil pressure. The interior of the tank is plastered with a waterproof compound, over which are applied several coatings of silicate of soda. An airtight cover is provided on the top of the tank and the necessary provisions are made to allow pumping the oil back into the transformers when repairs have been completed. It is not expected that the oil will have to remain in the concrete tank for any great length of time so that the leakage, if there is any, will be practically negligible. The matter of providing proper housing for repairs and storage of oil may at first seem to be somewhat of a refinement; it nevertheless is important in large installations if it is desired to keep the cost of repairs at a minimum and at the same time avoid delays in placing equipment back into service. In many instances lack of attention to the matter of repair facilities has resulted in delays, with a consequent loss in revenue to the central-station company. It must not be inferred, however, that making repairs constitutes a serious difficulty, as with reliable apparatus and proper accessibility it is often easier to make repairs outdoors than indoors, where lack of room sometimes handicaps the repair men.

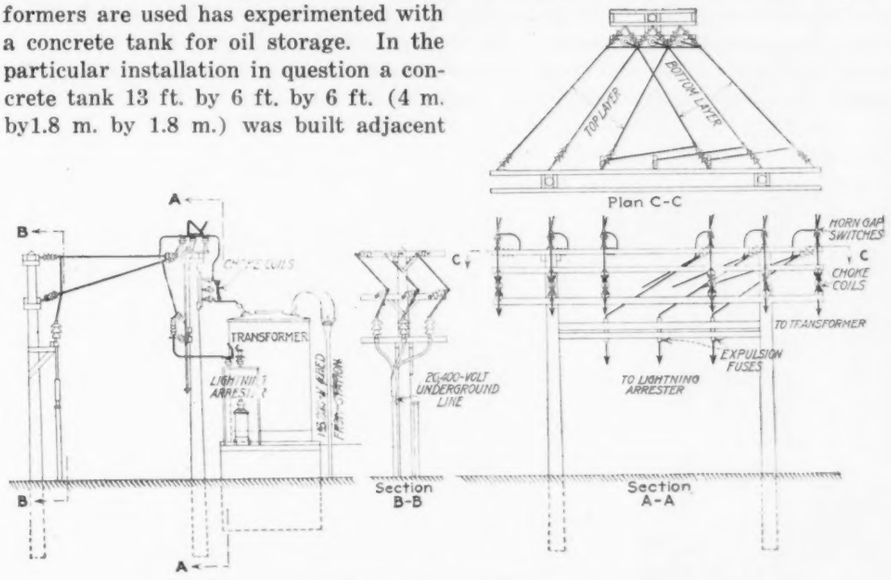


FIG. 5—SECTION AND PLAN OF OUTDOOR STATION SHOWN IN FIG. 4

Cooling Transformers

Adequate cooling may be provided for transformers by three different methods: (1) Cooling tower; (2) spray pond; (3) deep-well pumping outfit. The objection to the spray pond is the amount of room required for this type of installation, as in order to obtain sufficient spraying surface an area 50 ft. by 50 ft (15.2 m. by 15.2 m.) is required for even a moderate-sized in-

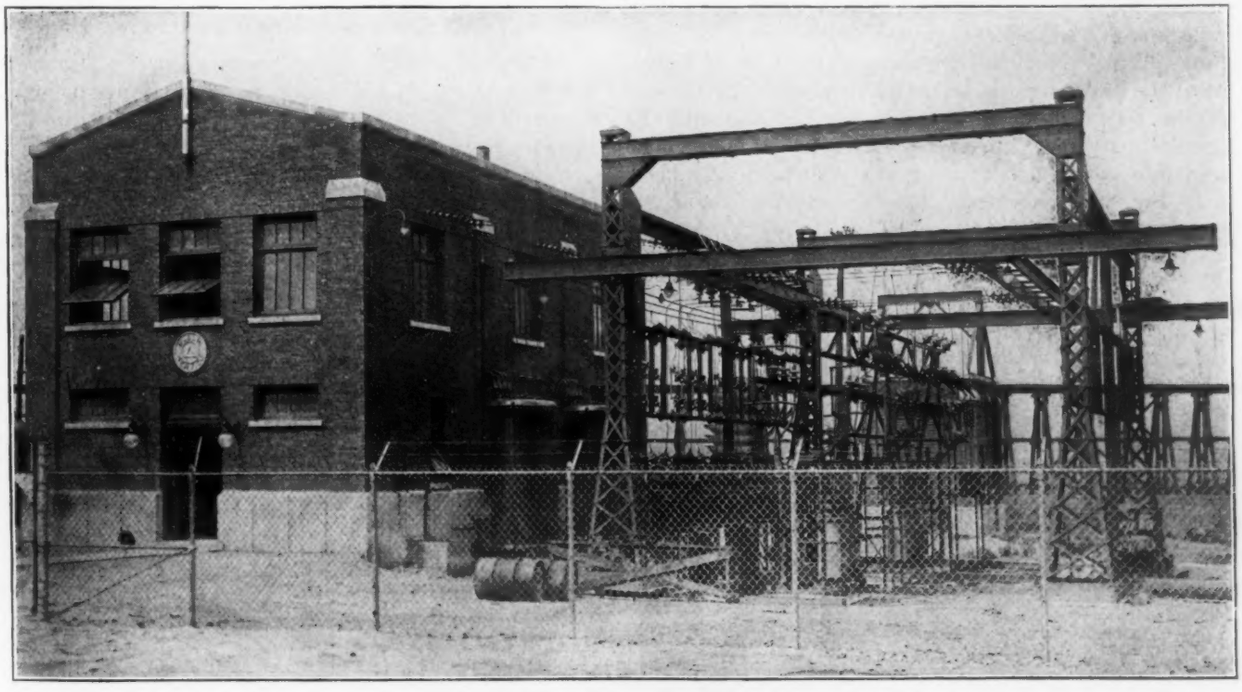


FIG. 6—SEMI-OUTDOOR INSTALLATION

stallation. A cooling tower may be of two types, one commonly called the forced-draft cooling tower and the other the atmospheric cooling tower.

What might appear to be an objection to both the spray pond and cooling towers is the fact that in the hottest months when the greatest amount of cooling is needed the relative humidity is also greatest, consequently the theoretical dew point is raised so high that it becomes a rather difficult matter to bring the circulating water temperature down to the required value. In one installation, in order to overcome this difficulty a deep well was driven, and the water supply obtained from this well was practically constant all the year at a temperature of 52 deg. Fahr. (11.2 deg. C.). To dispose of the water a second deep well was driven and the circulating water pumped back into it and allowed to seep into the ground through the various earth strata.

In Fig. 9 is shown an outdoor installation with an atmospheric cooling tower on one side of the property. The tower has a capacity of 50 gal. (189.3 l.) per minute, occupies a space 7 ft. by 11 ft. (2.1 m. by 3.4 m.) and is 15 ft. (4.6 m.) high. The cooling surfaces or decks consist of drip bars and the louvers inclose the tower on all sides and are constructed of No. 22 galvanized corrugated steel plate.

The guarantee conditions for the tower are based on average weather conditions for the place of installation, the hottest month being chosen as representing most severe operating conditions.

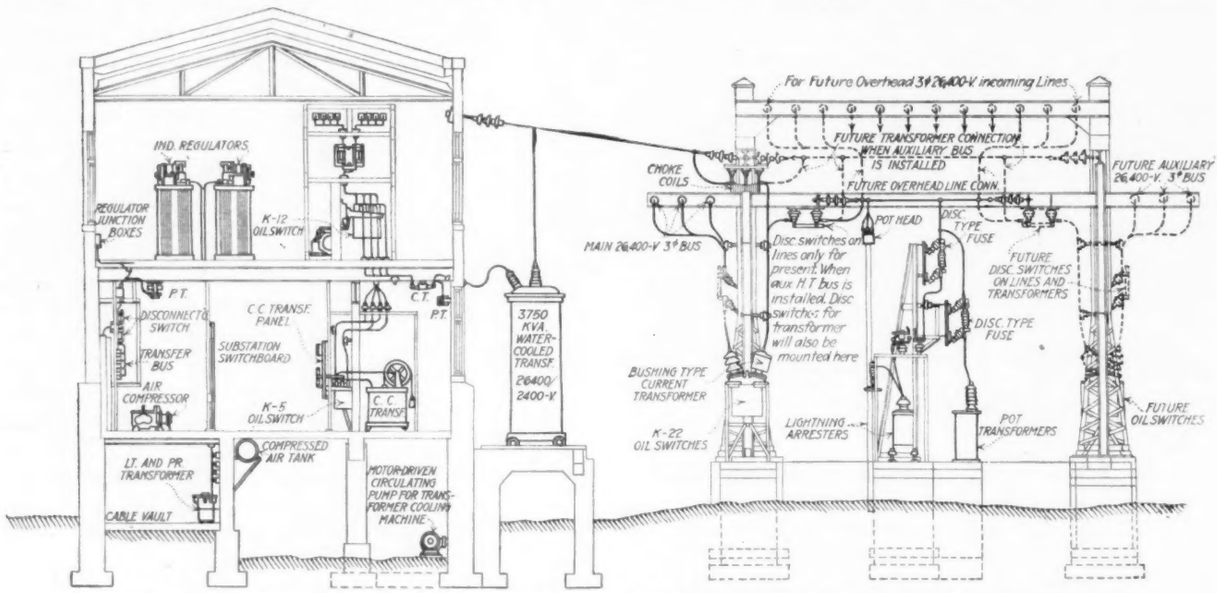


FIG. 7—LONGITUDINAL SECTION AND MAIN CONNECTIONS OF SEMI-OUTDOOR INSTALLATION SHOWN IN FIG. 6

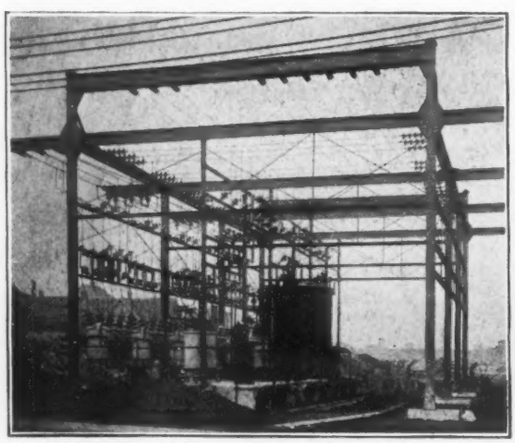
The following figures were used in calculating temperature range for a tower on the Atlantic seaboard:

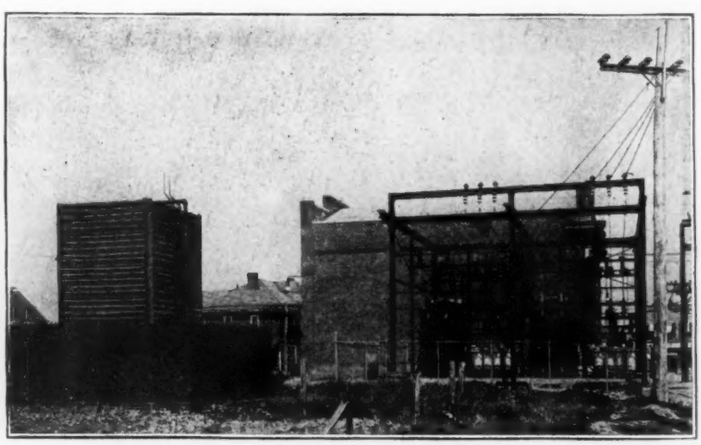
Mean July temperature (deg. Fahr.)	73.5
Mean July wet bulb (deg. Fahr.)	67
Mean July humidity (per cent)	71

Assuming water leaving the transformer coils at 100 deg. Fahr. (37.8 deg. C.), the temperature of water leaving the tower is obtained by substituting in the formula $T_1 = (T + 2t_1 + t) \div 4$.

t = temperature of atmosphere

t_1 = temperature of wet-bulb





FIGS. 8 AND 9—26,000-VOLT OUTDOOR INSTALLATION ADJACENT TO EXISTING GENERATING STATION, AND OUTDOOR SUBSTATION WITH COOLING TOWER CONNECTED WITH TRANSFORMERS

T = temperature of water on tower

T_1 = temperature of water off tower

$T_1 = (90 + 134 + 73.5) \div 4$

$T_1 = 74.4$ deg. Fahr.

During winter weather considerable trouble may be experienced due to freezing of the water in the pans, but by installing a by-pass valve and piping so as to utilize only the bottom tray the freezing is eliminated.

In conclusion it may be said that the modern up-to-date outdoor substation has come to stay and its evolution has gone steadily forward. The outdoor equipment is well adapted for furnishing both the small rural load and the more important industrial centers. It is far more simple than the indoor type and more space may be occupied with less money expenditure both in structures and equipment, with the resultant advantage that no needless expenditure has been made on useless inclosures and barriers.

The problem of cooling the equipment has been solved in both the small and large size installations so that it is no longer necessary to provide expensive housing for large capacity transformers.

High-tension insulators, terminals and switches have been developed to such an extent that they may be as safely operated outdoors as when installed under cover, free from the action of the elements.

The development of the outdoor substation has been one of the most important factors in the interconnection of high-tension electrical systems and by its means considerable fuel saving may be accomplished in that the most economical generating units may be employed for long-hour use for serving the transmission lines through outdoor substations feeding concentrated industrial centers.

In these days of conservation of labor and building material, the outdoor substation is a step in the right direction as its construction not only releases the experienced labor employed in building construction but also releases cars and barges which may be used to better advantage in the transporting of coal and other materials which are of vital importance in hastening the victory of the Allies.

Present War Production Made Possible by Utilities

Central Stations Provided Power Without Delay, Affording War Industries an Opportunity to Study Other Production Problems—Financing New Extensions Is Now a Serious Problem That Confronts the Companies

WHEN the full story of this great war is written, at least so far as this country's participation is concerned, the vital part which the public service companies have played should receive thorough recognition. It is not too much to say that the United States would have been absolutely unable to contribute its share, or at least what the rest of the world confidently expected this country to produce, in the way of machinery for the winning of the war—the word machinery being used in the broader sense, as it applies to every cog and link and buttress in the war structure—were it not for the facilities immediately at hand which the public utilities were able to offer.

Granted the ability to erect buildings, factories of every description, shipyards and cantonments, etc., all of which was done in record time and at huge expense, all these structures would have been worthless—these built-over-night industries futile—without power supply. The manufacturers of generating apparatus and prime movers could not have supplied sufficient isolated-plant equipment, capable of supplying power capacity for all these war industries, under two or three years' time.

The public utilities were called upon to supply the demand. That this demand immediately became a very serious one was due to the fact that certain localities, because of their transportation facilities—water and rail—were natural centers where the government could not only develop existing plants but build new ones with the prospect of maximum and immediate production. Because of this situation the Philadelphia district, with its many natural advantages, immediately became one of the most important war industrial centers, if not the most important. In speaking of the Philadelphia district is meant, roughly, the territory contiguous to the Delaware River, from Bristol, Pa., on the north, to Wilmington, Del., on the south.

In this district are new and old shipbuilding plants whose production will be not less than 50 per cent of the entire shipbuilding output in the United States. If ships will win the war, it is obvious that the Philadelphia district is going to have a tremendous share in this eventuality. In addition to the shipbuilding industry, there is hardly a branch of war work which is not represented by one or more factories in the district, from the manufacture of large and small caliber field guns and howitzers, rifles and shells of all calibers and heavy armament—all the way up and down the scale—to storage batteries, chemicals and textiles.

FIG. 1—TIE-LINE RELEASING RESERVE EQUIPMENT FOR SERVICE

The expansion of old industries and the building up of new ones naturally introduced a civic problem of great difficulty. The shifting of labor became tremendous,

and the influx of additional workmen with their families and the housing and transportation of this new army presented numerous difficulties.

In the final analysis, the central station became the main source of supply. All lines seemed to lead to it —power for the factories, light for the dwellings, power for the transportation companies to take the laborers to and from their daily toil, etc.

This condition immediately developed into a serious problem for the central station. Where was the capacity

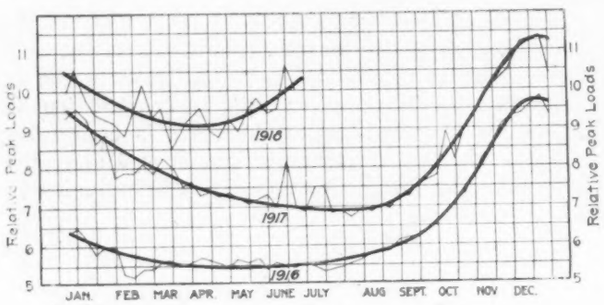


FIG. 2—HOW MONTHLY PEAK LOADS HAVE INCREASED SINCE WAR BEGAN

to come from, and, not less serious, how was it to be financed? For it must be borne in mind that the central station, in spite of tremendously increased operating expenses, furnishes power to the government not at a cost plus basis but according to the regular scheduled rates and tariffs.

Fortunately the Philadelphia Electric Company had laid its plans, prior to this country's entering the war, for the erection of a 120,000-kw. plant on the Delaware River at Chester. This plant will have two 30,000-kw. turbines operating within a few weeks. A 66,000-volt tie line has been constructed and is in operation, connecting the old Chester plant and the new plant with the main generating station in Philadelphia. The additional capacity afforded in this way is not sufficient, however. Plans were made for another 180,000-kw. plant on the Delaware River, but, unfortunately, about the first of the year all work on this new plant had to be discontinued because of the impossibility, prior to the passing of pending legislation at Washington, of financing the operation.

The situation, naturally, is a very serious one as the company approaches the period of fall and winter demand. Many thousands of kilowatts have been connected to the lines on an off-peak basis, while some 30,000 kw. to 50,000 kw. of new business, practically all war business, cannot be connected at all, pending an increase in station, substation and transmission capacity.

The generating, substation and transmission system which furnishes central-station power to Philadelphia, the adjacent district and Delaware County covers a semi-circular area whose base is on the Delaware River, between Tacony on the northeast and Chester on the southwest, which territory covers an area of two or three hundred square miles.

The bulk of the power delivered to this district is supplied from four main generating plants. Stations A-1 and A-2, which are, for all practical purposes, operated as one station and known as the Schuylkill Waterside Station, are at Twenty-eighth and Christian Streets, approximately the center of this district. The northern section is supplied by a generating station at Tacony, Pa., and the southern section of the district is supplied by a generating station at Chester, Pa.

In addition to these generating stations there are five smaller plants distributed throughout this area. With the exception of one furnishing power to the old Edison underground system, these are used mainly for the generation of power for municipal lighting.

To supply the increased demands for power due to the recently built munition plants and shipyards in this district a new station of 120,000 kw. is now nearing completion in the southern district. Two units of 60,000 kw. rating will be placed in service in a short time.

The transmission system serving commercial lighting and industrial power loads carries 13,200-volt, 50-cycle, three-phase energy. The Pennsylvania Railroad electrification and the street railways in the central part of the city are supplied from the 13,200-volt, 25-cycle system. In order to obtain greater flexibility of operation the 25-cycle and 60-cycle systems are tied together through a frequency-changer station with a normal rating of 18,000 kva.

The main generating stations are tied together by heavy trunk lines approximately paralleling the Delaware River. These lines, operating at 13,200 volts, are used in the transfer of considerable amounts of energy between stations or in supplying the substations from either of the generating stations. In addition to the 13,200-volt trunks there is now in operation a 66,000-volt transmission line, approximately 12½ miles (20 km.) in length, capable of carrying 30,000 kva. between

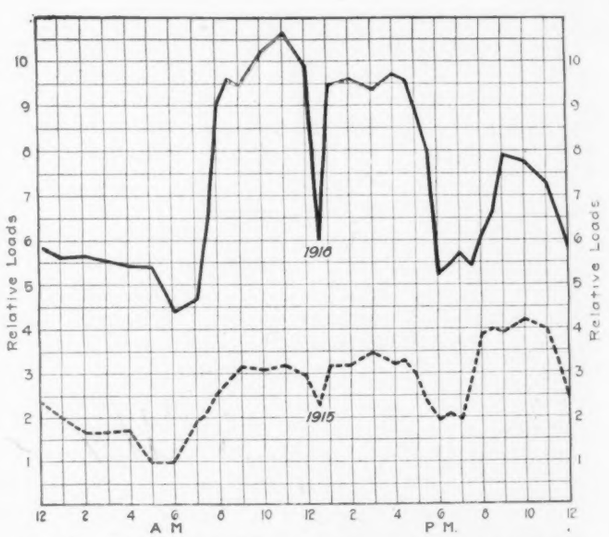


FIG. 3—TYPICAL SUMMER LOAD CURVES NOW AND DURING EARLY DAYS OF WAR

the Twenty-eighth and Christian Street stations and those in the southern section. This line is used not only to transfer energy between these two generating centers but also to feed a considerable amount of power to the munition and shipbuilding plants along the Delaware River.

The distribution system is supplied by approximately fifty industrial and company substations. Power is delivered to the industrial substations at 13,200 volts, three-phase, while the company substations transform

the energy either to 2400 volts, 60-cycle, for distribution over its lines in the central district, or to 110/220-volt direct current for distribution to the Edison district.

The entry of the United States into the war and the subsequent tremendous demand for all sorts of war equipment have totally changed the character of the manufacturing industry in Philadelphia. From being the "workshop of the world" and leading in the manufacture of articles of such widely diversified nature as locomotives, textiles, chemicals, carpets, street-railway cars, felt hats and saws, Philadelphia was transformed almost overnight into a city of war industries.

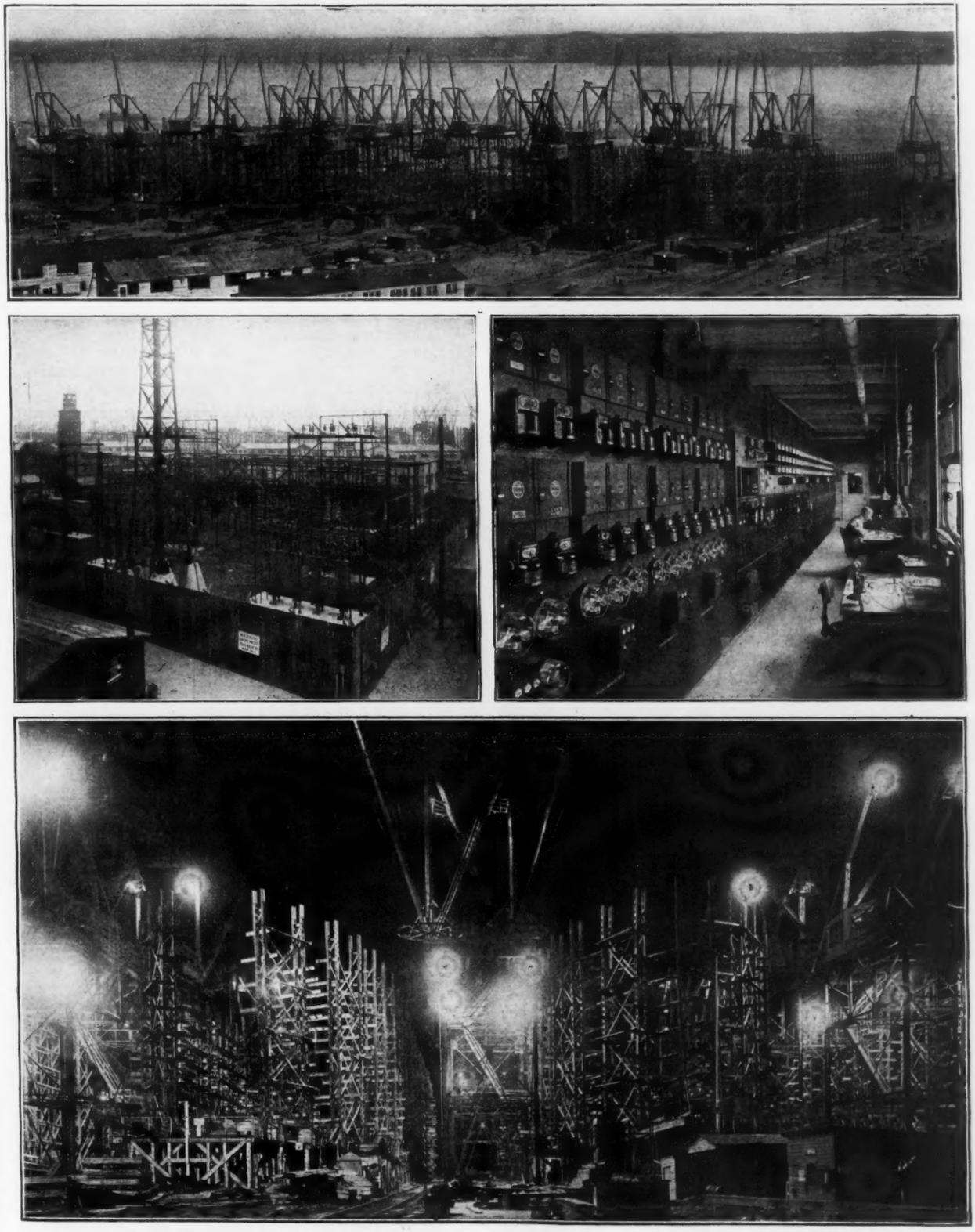


FIG. 4—GENERAL VIEWS AT LARGE SHIPBUILDING YARD SERVED BY PHILADELPHIA ELECTRIC COMPANY

The most important war industries served by the Philadelphia Electric Company and its subsidiary, the Delaware County Electric Company, in point of size and energy consumption, are the munition factories, arsenals and shipbuilding companies. Under the classification of munitions are included shells of all sizes and types as well as bombs—trench-mortar bombs, depth bombs and aerial bombs. The supplying of energy to the arsenals has an added interest because of the fact that Philadelphia Electric energy is used in every operation possible in the manufacture of the guns from the time the ingot is delivered until the gun is completed. This includes the gun carriage as well.

The shipbuilding industry on the Delaware River in Philadelphia and vicinity has always been a considerable factor in the shipbuilding trade of the country, but since the entry of the United States in the war and the consequent backing of the industry by the government it has, of course, greatly increased production. It is estimated that as soon as all the added facilities are completed a ship a day will be launched on the Delaware. They will be of many types—from the steel freighter of 11,000 tons deadweight down through all the grades and sizes to the 1000-ton wooden ships. With one or two exceptions, these plants are all served by the Philadelphia Electric Company.

The demand for power by the war industries has been little short of overwhelming in Philadelphia, as shown by the curves in Figs. 2 and 3, which indicate relative loads only. Part of the demand has been due to increased manufacturing facilities in the shape of extensions to existing plants. All hitherto idle machinery has been thrown into service, and the manufacturers are driving to the utmost every bit of existing equipment in order to speed up production. Where possible they are operating on a twenty-four-hours-a-day basis, but owing to the scarcity of both skilled and unskilled labor the best they can do in most cases is to operate in two shifts.

The war is revealing more and more sharply to the public at large the importance of the public utility—particularly the central station—in the conduct of the world's business. The Fuel Administrator's priority decision regarding fuel shipments to public utilities has opened the eyes of the "man on the street" to what he has been taking more or less for granted—the absolute dependence of the community on its public utilities.

The overnight establishment of war industries has also revealed very clearly the fallacy of the isolated-plant principle. Many manufacturers using central-station service found it was a simple matter to expand their facilities to take care of war business. On the other hand, many of those who were burdened with their own generating plants found that they had not the extra capacity for the new business, nor for that matter could they have secured additional labor and fuel without a great deal of difficulty. So they turned to the central station. Where new factories were built or additions made to existing plants, it was quickly found that central-station service was the only answer to the power problem. It was first of all impossible or unwise to divert the necessary capital into the purchase of a generating plant. Deliveries of prime movers and other necessary electrical equipment were on a one, two and three year basis. Labor and coal were high in price and exceedingly difficult to secure. All these factors would have made the cost per useful kilowatt to the war products manufacturer disproportionately high even had he been successful in building and equipping his generating plant.

But the final and determining factor in most cases was the central station's ability to deliver energy immediately. While central-station executives and engineers have been harassed to the breaking point almost by the same difficulties as experienced by individual manufacturers—except that these difficulties have been on a much larger scale—they have nevertheless made available large blocks of power to the war industries, and their superior resources along this line have naturally enabled them to expand with comparative speed.

While it may be assumed that these conditions hold true in any territory devoted to the manufacture of war industries, they have been particularly applicable to the Philadelphia district. As an instance, a huge shipbuilding plant in the process of building had an immediate requirement of 600 kw. As soon as it was ready to begin operations, arrangements were complete to supply it according to its requirements. This initial requirement was only an insignificant part of the final total connected load. In another case a famous old concern was building a huge new plant for the manufacture of munitions. Here it was a question again of time—it would have been impossible for this firm to provide its own electricity even if it had desired to do so. Its immediate requirement was 1000 kw., and by the time the new plant was partly ready to operate the energy was available.

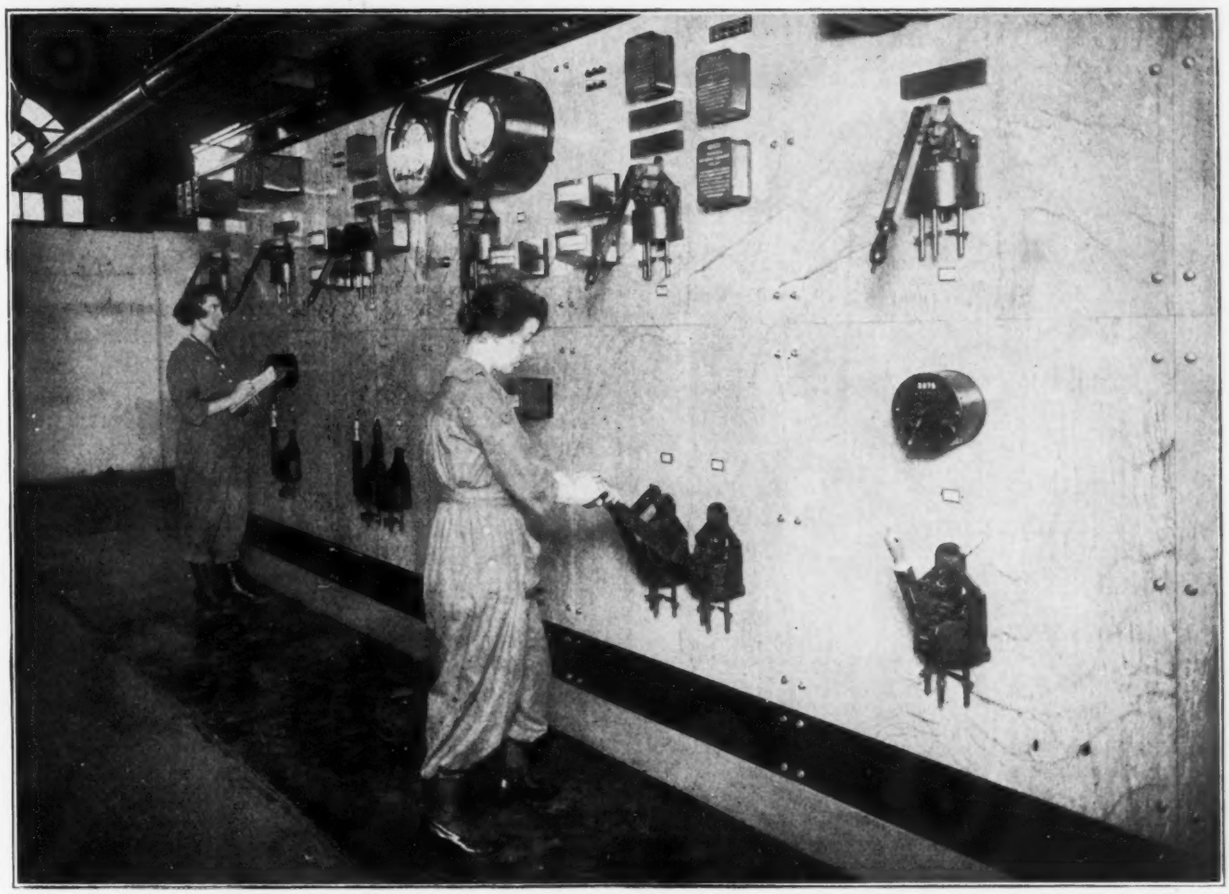
PARTIAL LIST OF PRODUCTS FOR WAR PURPOSES NOW MANUFACTURED IN PHILADELPHIA AND VICINITY WITH CENTRAL-STATION POWER

Ships	Food for U. S. Army
Explosives	Soap and lye
Railway supplies	Auto parts and floats for submarine nets
Machine and trench tools	Balls and ball bearings for Liberty motors
Hosiery	Parts for range finders
Submarine batteries	Gas masks
Submarine engines	Water jackets for machine guns
Parts for U-boat chasers	Fabricated iron and steel for ships
Shipyard cranes	Chemicals for explosives
Truck parts	Cameras for aeroplanes
Cloth for uniforms, blankets	
Fertilizer and chemicals	
Drugs	
Bayonets	
Steel forgings	

This is much more than a war to alter the balance of power in Europe. It is a war to make the nations and peoples of the world secure against every such power as the German autocracy represents. It is war of emancipation. Not until it is won can men anywhere live free from constant fear or breathe freely while they go about their daily tasks and know that governments are their servants, not their masters.—*Woodrow Wilson.*

Woman Substation Operators a Notable Success

In a Month a Girl Who Never Heard of an Oil Switch Is Now Taught to Be an Assistant Operator—Pioneer Work by Boston Edison Company in Training Women for Electrical Service Yields Admirable Results



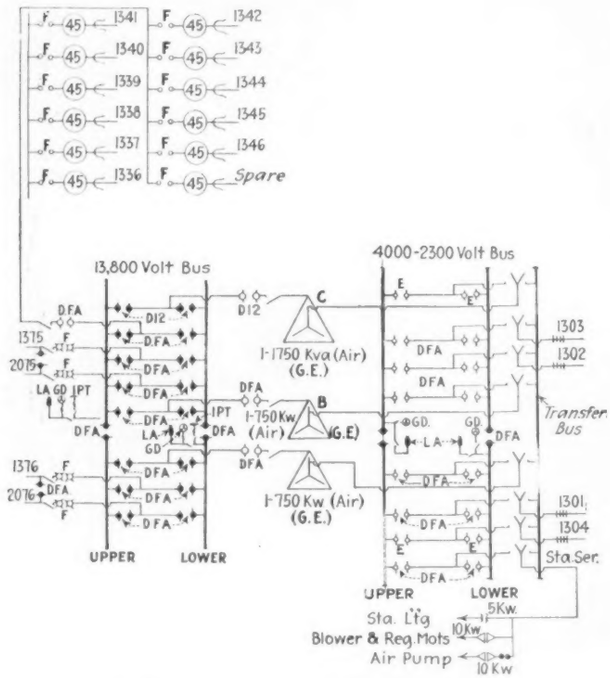
THE war has brought many changes in central-station practice, but few of these are more significant than the use of women as substation operators on the system of the Edison Electric Illuminating Company of Boston, Mass. While as yet only about thirty women are engaged in this work, there is every prospect that the number will be extended, in view of the entrance of station operators into the army, the navy or munitions plants and the difficulty of procuring men capable of being "broken in" for this service. The Roslindale and Dorchester substations are now operated exclusively by women, and the results appear to be admirable in every way. The service appears to be fully as reliable as though men were in charge of these substations. Emergencies have been skillfully met, and the effect upon the health of the operators has been uniformly good.

Last spring C. H. Parker, superintendent of the generating department of the Boston company, foresaw that continued war demands would make it more and more difficult to retain and to replace male operators in the substations. The company distributes energy over an area of about 700 square miles, and for this reason the substation service is of great importance. Steps were therefore taken to secure applicants through the various suburban stores of the company, no advertising being required. To R. E. Dillon, assistant superintendent of the generating department, was given the task of interviewing the women who applied for substation work and passing upon their qualifications.

In general, fitness depends upon character, size, physique and kind of work previously performed. Electrical knowledge or experience is not an essential. It has been found that where a girl has been doing heavy machine work or farm tasks she is usually better fitted to take up operating duties than is one whose experience has been purely clerical. A good grade of intelligence is requisite, although it is not essential that the applicant shall have completed even a full grammar-school education.

Upon accepting eighteen applicants, the company organized a course of training for them at the laboratory in the Massachusetts Avenue Service Buildings, and here the class was instructed in the fundamental principles of electricity. The initial course included textbook study, practical demonstrations, equipment set-ups, visits to the main generating plant of the company at South Boston, trips to substations, lectures, blackboard talks, examinations and reviews. The course was completed in a classroom partitioned off from the op-

erating room at the Roslindale substation, the first installation to be operated exclusively by women in America. From the start of the work at the substation two students were detailed from the class daily to act as assistants to the male operators on shift. This gave them an insight into the routine work. Thorough instruction was given in the care and operation of rectifiers, transformers, regulators, oil switches and other equipment. Special study was given to the "general



ARRANGEMENT OF ROSLINDALE SUBSTATION

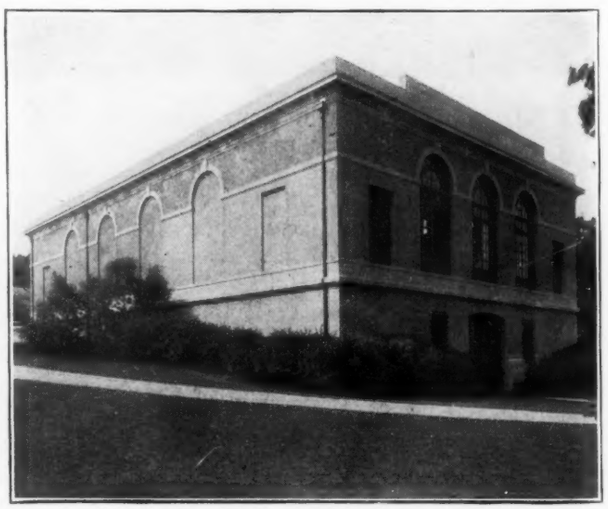
orders" of the company and to methods of meeting emergencies. On May 29 nine students went on watch at the Roslindale substation, the male assistant operators being transferred to other stations, leaving only the operators, who were kept at Roslindale for the purpose of giving instruction in handling the substation routine. They were also given orders to act in a supervisory capacity and not to interfere except to prevent a serious error. On July 5 the remaining male operators were removed from the substation, leaving the women in entire charge. One of the former operators was retained to make repairs on apparatus and to act as an emergency operator, but the substation has been in the hands of women since the foregoing date. The original course has been shortened to about thirty days since the first class completed its work, and this is now the standard time for instruction.

The provision of separate lavatory facilities is the only change of importance required in the transfer of a substation from men to women operators, with the exception of extension handles for more easily setting oil switches. The latter are illustrated herewith. This extension piece consists of a treated wooden handle about 18 in. (45.72 cm.) long and 1½ in. (38 mm.) square, fitted at one end and near the middle with two iron straps to engage the head and shank of the ordinary switch handle. The strap at the lower end is of ¼-in. (6.3-mm.) stock, 1 in. (25 mm.) wide and 3⅜ in. (84.9 mm.) long, and is bored with two $\frac{5}{16}$-in. (7.9-mm.) holes through which a pin 3 in. (75.4 mm.) long is carried when the extension piece is attached to the main handle. For some types of switch handles a wooden filler block is required at the lower end of the extension piece.

On July 17 the Dorchester substation was taken over by women operators. At this substation two members of a second class of applicants undergoing instruction were detailed to be "broken in" by the women operators. This work had previously been done by male operators, but was most satisfactorily accomplished under the new conditions.

The general arrangement of the Roslindale substation from the electrical point of view is shown in the accompanying single-line wiring diagram. The substation supplies energy for power, commercial and street lighting and has a rating of about 3790 kw. There are three banks of air-cooled transformers, two sets of 13,800 volt buses and a set of upper, lower and transfer buses for 4000/2300-volt service, besides an installation of 540 kw. in street-lighting transformer and rectifier equipment. The women operators are, of course, required to understand the detailed arrangement of all equipment in the substation, its handling and relations to the outside lines. The diagram symbolizes the daily work of the operators and is, of course, as familiar to them as to the men whom they succeeded.

The first class began its studies on March 25, and the first substation was completely taken over by women a little more than three months later. The revised course, as given by Mr. Wellington of the generating department, covers about a month. The women operators are paid the same wages as were the men and are also under compensation while studying. It is customary to take each class over to the South Boston station two or three times during the course in order that the general principles of electrical production may be set forth more effectively, the work of the load dispatcher seen, etc. The course is arranged to occupy six days per week, and a part of the work consists in meter reading by the entire class at substation switchboards, as well as circuit tests required in routine operation.



ROSLINDALE SUBSTATION, BOSTON EDISON COMPANY

The schedule of instruction is followed as closely as possible, but if occasions arise which necessitate a de-

parture from the program, this is carefully noted for use in future courses. It is not the plan to hold the class to the exact minute in its curriculum, although the schedule has been planned on such a basis, to serve as a guide. Subjects in hand are carried out until completed. Every sixth day a review of previous work is held during the morning periods, and a written examination is held during the afternoon periods. The results of the examination then serve as a guide in the work of the following five days.

In general, the instruction starts each morning at 9 o'clock and a half-hour of meter reading follows. From 9:30 until 10:45 the class is then given either a talk or a demonstration, lasting until 10:45, upon the principles or practical application of equipment. A fifteen-minute recess is then followed by further in-

SYNOPSIS OF COURSE OF INSTRUCTION IN SCHOOL FOR FEMALE OPERATORS

Course to consist of three parts, as follows:
Part I—Preliminary, progressive.
Part II—Theoretical, progressive.
Part III—Practical, non-progressive.
Either two parts or all three parts of the course are combined as it progresses.

PART I—PRELIMINARY

1—ELECTRIC POWER.
(a) Definition.
(b) Journey of a pound of coal from coal mine to lamp socket.
(c) What is to be found in a power plant.
(d) What is to be found in a substation.

2—THE EDISON COMPANY—*Generating Department.*
(a) Some statistics on number of stations, yearly output, daily output, daily maximum demand, classes of power generated and distributed, etc.
(b) Kinds of stations: (1) Steam-engine stations, (2) steam-turbine stations, (3) motor-generator substations, (4) transformer substations.
(c) The generating department: (1) Personnel of department, (2) personnel of operating force, (3) duties of operating force.
(d) Outline of work in substations: (1) Watches, (2) changes and days off, (3) vacations, sick benefits, etc., (4) notifications in case of absence for any cause.
(e) Visits to stations: (1) Fourth station, (2) thirty-eighth station, (3) ninth station, (4) forty-third station.

3—ELECTRICAL APPARATUS.
(a) Visit to stock room—nomenclature of apparatus.
(b) Electrical terms — synonymous terms, definitions of various expressions in use.

PART II—THEORETICAL

1—ELECTRICITY.
(a) Nature and analogy.
(b) Static and current electricity.
(c) Methods of producing electricity: (1) Mechanical, (2) chemical, (3) thermal.
(d) Conditions necessary for current flow.
(e) Properties of conductors and insulators—wire sizes, etc.
(f) Effects of current flow: (1) Magnetic, (2) thermal, (3) electrolytic.
(g) Ohm's law—units, ampere, volt and ohm.
(h) Resistance in series and parallel.
(i) Characteristics of series and parallel connections.
(j) Power: (1) Watt and kilowatt, (2) relation between electrical and mechanical power.
(k) Electrical diagrams: (1) Symbols, (2) one-line diagrams and others.

2—PRACTICE.
(a) Methods of connecting apparatus: (1) Series, (2) parallel.
(b) Methods of making: (1) Splices, (2) taps, (3) different types of connections to apparatus.

3—ELECTRICAL APPARATUS IN GENERAL.
(a) All types of circuit breakers, switches, etc.
(b) Incandescent lamps and accessories.
(c) Fuses.
(d) Bells and signals.
(e) Wiring principles and practice: (1) Conduits, cleat work, etc.; (2) line wiring, overhead and underground; (3) high-tension wires and cables.

4—MAGNETISM.
(a) Relation to electricity.
(b) Laws of magnetism.
(c) Electromagnets.

5—BATTERIES.
(a) Types: (1) Dry cell, (2) wet cell.
(b) Characteristics.
(c) Uses and methods of connecting.
(d) Storage batteries, elementary: (1) Characteristics, (2) application.
(e) Why batteries are not used instead of generators.

6—METERS AND INSTRUMENTS, DIRECT-CURRENT.
(a) Types.
(b) Description of: (1) Ammeter, (2) voltmeter, (3) wattmeter, recording.
(c) Applications and connections.

7—PRINCIPLES OF INDUCTION.
Lenz's law.

8—DIRECT-CURRENT APPARATUS.
(a) Dynamos, elementary: (1) Principles, (2) types—characteristics.
(b) Motors, elementary: (1) Principles, (2) types—characteristics.
(c) Operation of dynamos and motors.

9—ALTERNATING-CURRENT ELEMENTS.
(a) Description and analogy.
(b) Sine wave, elementary.
(c) Lead and lag.
(d) Impedance.
(e) Phase.
(f) Power factor.
(g) Alternating-current circuits: (1) Single-phase, (2) polyphase, (3) transmission lines, (4) feeders.
(h) Alternating-current power.
(i) Alternating-current connections: (1) Delta, (2) "Y"—characteristics of each.

10—ALTERNATING-CURRENT APPARATUS.
(a) Alternators, elementary—theory and characteristics.
(b) Motors, elementary—theory and characteristics.
(c) Meters: (1) Ammeter, (2) voltmeter, (3) indicating wattmeter, (4) recording wattmeter.
(d) Transformers: (1) Theory; (2) applications; (3) Characteristics of power transformers, instrument transformers, and constant-current transformers; (4) Connections—delta and "Y."

PART III—PRACTICAL

1—APPARATUS IN STATIONS.
(a) Location.
(b) Diagrams.

2—OIL-BREAK SWITCHES.
(a) Theory.
(b) Types: (1) Hand-operated, (2) remote-control.
(c) Manipulation.

3—DISCONNECTING SWITCHES.
(a) Purpose.
(b) Manipulation.

4—RECTIFIERS.
(a) Theory.
(b) Theory of tubes.
(c) Constant-current transformers.
(d) Connections.
(e) Operation.
(f) Series circuit characteristics.
(g) Arc lamps, etc.

5—LIGHTNING ARRESTERS.
(a) Theory.
(b) Operation.

6—REGULATORS.
(a) Theory.
(b) Operation.
(c) Auxiliary apparatus: (1) Contact-making voltmeters, (2) line-drop compensators.

7—PROTECTIVE SYSTEMS.
(a) Methods of protecting apparatus.
(b) Methods of protecting lines and circuits: (1) Overload and time-limit protection, (2) balanced protection.

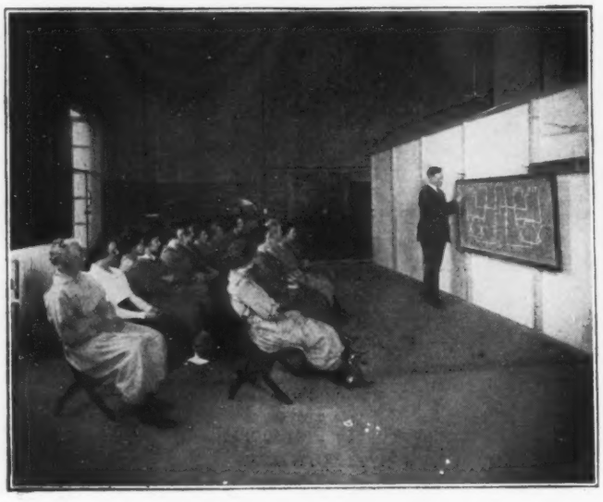
8—OPERATING, ELEMENTARY.
(a) Principles of operating—precautions, red tags, etc.
(b) Layout of buses.
(c) Transformers: (1) Starting up and shutting down, (2) air-cooling system in use.
(d) Station service panel.
(e) Arc-circuit test.
(f) Low-tension phase test and check.
(g) Testing of potential transformer fuses.

9—OPERATING, ADVANCED.
(a) Switching operations, 4000-volt board: (1) Changing over buses, (2) grounds, (3) short circuits, (4) live crosses, etc., (5) use of transfer bus.
(b) Switching operations, 13,800-volt board: (1) Loss of commercial line, (2) general switching operations on order from load dispatcher

10—MAINTENANCE.
(a) Minor repairs.
(b) Station routine.
(c) Battery-charging, forty-third station.
(d) "General orders."
(e) Reading of meters.

struction or by observation and participation in substation test or switchboard handling until noon. Usually the half-hour from 1 p.m. on, after lunch, is given to informal discussion of matters arising in the course or noted in substation visits. From 2 to 5 p.m. intensive instruction continues, with a fifteen-minute recess beginning at 2:45 o'clock. In this period there may be a visit to another plant, perhaps accompanied by an hour of drawing by the class of wiring layouts, etc. From six and one-half to seven hours a day are given to instruction work. At the close of the course an allowance of about a week is made for necessary review work and final practice in switching operations, depending upon the fitness of the class members. The "general orders" of the company are given an increasing amount of study as the course progresses. A detailed schedule of the topics covered in the course is printed on the preceding page.

The operators wear a so-called "farmerette" uniform, selected by them at a Boston department store in response to the company's prohibition of skirts while on duty. This uniform fulfills the "safety first" requirement without completely sacrificing feminine taste.



INSTRUCTING WOMEN IN SUBSTATION OPERATION

INTERIOR OF ROSLINDALE SUBSTATION

EXTENSION HANDLES USED ON OIL SWITCHES AT ROSLINDALE SUBSTATION

The course of instruction occupies about 160 hours, divided as follows:

	Hours
Lectures and demonstrations	108
Visits to stations	15
Reading indicating and recording instruments	12
Visit to Edison company's stock room	4
Manipulation of oil switches (principle)	1
Arc circuit test	3
Drawing diagrams of station apparatus and wiring layouts	11
Reviews and general discussions	6

Boiler-Room Management Plan

Between $50,000 and $100,000 Is Saved Annually by Indianapolis Company by the Investment in Trained Boiler-Room Men and in Adequate Boiler-Room Instruments

BY T. N. WYNNE*
Vice-President and Chief Engineer Indianapolis Light & Heat Company

THE best practice for making a fireman is to select a young man and teach him the job. This course of instruction should last at least two years, and his time should be divided between operating and repairing. By repairing grates and stokers and cleaning and repairing boilers the student fireman familiarizes himself with the apparatus he is to operate and hence can fire with much greater intelligence. Too much time or pains cannot be taken with a man who is to handle the company's coal.

The fireman must be intelligent and honest—intelligent so that he can understand his instruments, and honest so that he will not make these instruments lie. In the average plant the fireman is turned loose on the coal pile and his job is to keep up steam. Usually there is no reference made as to how he is to do this, since he is supposed to have completed his education in the dim past and to require no further instruction. Our experience has shown that the average fireman must be watched very closely or he will do extremely wasteful things. As a general rule, especially in inclined-stoker or hand-fired plants, the fireman will fire and sit down, fire and sit down, and follow this plan throughout the watch. He will try to make his periods of sitting down last as long as possible by firing heavy and then letting the steam drop as far as he dares. He then starts a new cycle. The remedy for this is not to allow the fireman to sit down at all. This is made possible by having the fireman stand eight-hour watches and allowing no chairs or benches in the boiler room. This is not a hardship to the fireman. When he knows he is not supposed to sit down, he interests himself in his work and forgets about quitting time. This results in better and steadier fires and high economy.

A fireman should not be allowed or required to do any other work than attend to his fires. It is the practice in some plants to require the fireman to look after pumps, heaters, etc. This of course is practical in a very small plant, but in larger plants it is decidedly not so. It gives the fireman an excuse for poor fire regulation. He cannot be blamed for having a wasteful fire if he is at that moment packing a pump.

A certain number of instruments are absolutely necessary in order to determine the degree of economy being obtained by the boiler and grate. A boiler and grate has a maximum efficiency at a certain rating. This rating should be found by an actual boiler test. This point of greatest economy is usually around 160 per cent of boiler rating. This rating should be maintained continuously, except of course in cases where it is necessary to crowd the boiler, as at peak load. This is where the underfeed stoker has the advantage over the other types. It can be operated during off-peak hours at the point of highest efficiency and crowded, as has been demonstrated, to 400 per cent of rating during peak hours. Operating at 400 per cent is decidedly uneconomical, but it is no more so than carrying banked boilers. The instrument to give this information regarding rating is the steam-flow meter.

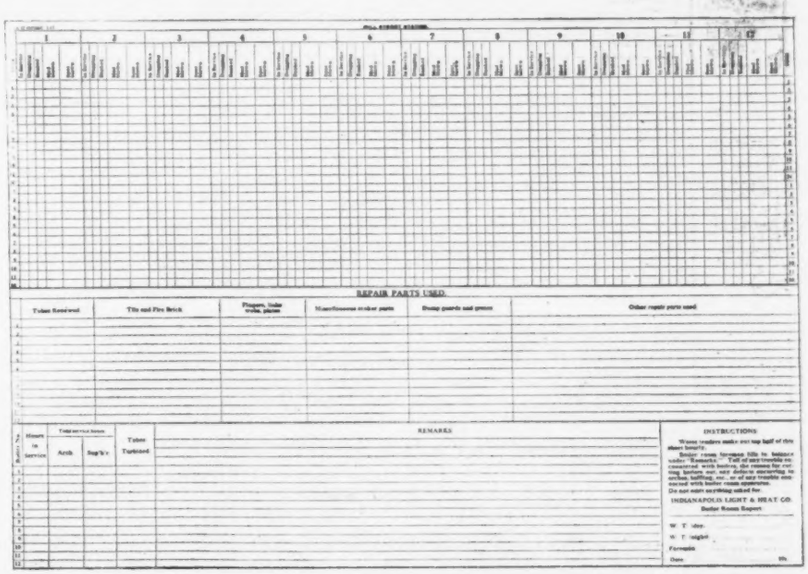


FIG. 1—COMPLETE BOILER-PLANT RECORD

This instrument is the most essential of all the appliances of the boiler room.

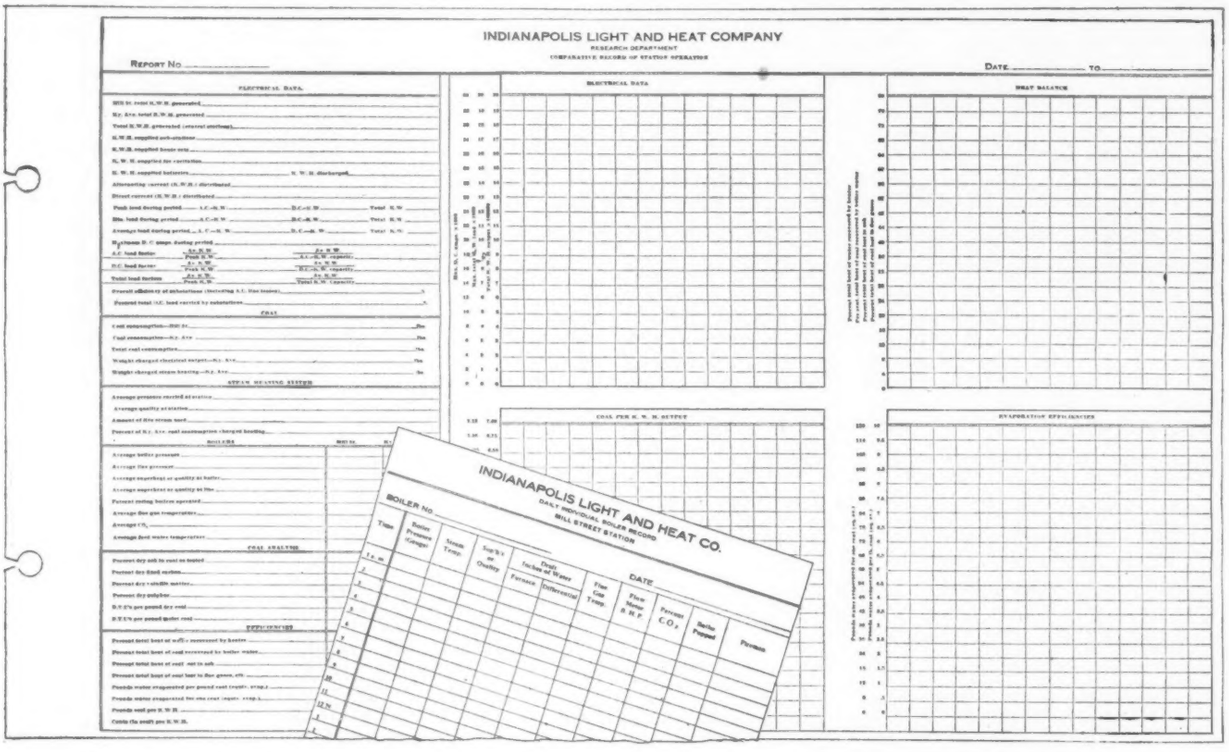
The B.t.u., ash, sulphur and moisture must be determined for the coal being burned. Increase in ash and moisture decreases the B.t.u. and consequently increases the freight bill and maintenance cost per thousand B.t.u. In these days of coal shortage it is next to impossible to get the desired quality of coal, but no let-up should be made in the demand for the best coal available. Sulphur affects the rating which can be obtained from grates, especially of the inclined type, but it is not an appreciable factor on chain grates or certain kinds of underfeed equipment. At the present time with No. 4 coal not available it is useless to enter into a discussion on the effects of sulphur. From the foregoing it will seem that a calorimeter and some sort of coal-weighing apparatus should be used. A sample of

*From a paper read before the Indiana Electric Light Association, Aug. 7, 1918.

coal should be taken from each car so that the entire car will be represented in the sample. A car sample should weigh about 1000 lb. (453 kg.). This sample should be handled in the manner laid out by the American Society of Mechanical Engineers. The weighing of the coal and ash can be done on scales suited to the purpose of the particular plant.

Special pains must be taken at all times with the fire. At normal loads a thin, fast fire is probably the best. With a thin fire holes are more apt to occur than in a thicker one. Hence the thin fire needs more attention, and this may account for the fact that the thicker fire predominates. A draft gage will tell the condition of the fire better than anything else and not the boiler is clean. If the tubes are covered with soot and scale, the water will not absorb so much heat as otherwise. Soot is a good insulator and scale is not very far behind it. Soot can and should be removed at least every twelve hours by means of mechanical soot blowers, supplemented by a hand steam lance, for the soot blowers may not remove all the soot, and as a rule they do not, especially on superheater tubes. If soot is allowed to remain, it will soon become a very high insulator.

The flue-gas temperature should be as near the final heat of the steam as possible. As long as the temperature of the flue-gas remains constant the boiler is clean, but as soon as the temperature begins to rise



FIGS. 2 AND 3—COMPARATIVE RECORD OF STATION OPERATION AND DAILY INDIVIDUAL BOILER RECORD

eliminates opening the inspection door so often to look at the fire. Opening the inspection door means a momentary cooling of the gases. When the first boiler test is made the draft over the fire necessary for different thicknesses of fire and boiler ratings can be determined. These values can be plotted so that for any rating the thickness of fire is known, as well as the draft necessary and, in the case of stokers, the stoker speed.

Two draft-gage connections should be made—one over the fire and another at the damper or base of the stack. The latter shows the amount of draft available at all times. Other connections can and should be made in case a thorough watch is to be kept on the boilers. These connections should be in the ash pit and ahead of each baffle opening. These will keep a check on the places of greatest resistance within the boiler setting and will show if any of the openings are becoming stopped up.

The temperature of the outlet gases from the boiler setting to the stack is a good indication of whether or one of three things or all can be looked for—soot, scale or leaky baffles. Pyrometers are made so that one instrument may be used on any number of boilers, up to and including twelve, each boiler having its own thermocouple and leads back to the instrument.

Carbon dioxide, or CO_2, indicates the condition of the fire and the combustion of the gases. In a sense it is the ratio of the air used to the air that has not been used. If, in a test for CO_2, CO, or carbon monoxide, is obtained, it will be on account of one of the following reasons: insufficient air supply, improper furnace design, improper method of firing, too low a furnace temperature so that the gases are too cold to ignite, poor mixing of air and combustible gases, or poor selection of fuel. For the average Indiana coal and the amount of air required to burn it, 12 per cent CO_2 is a good figure. Low CO_2 is caused by an excess of air, insufficient air (which would cause high CO) or improper mixture of air and gases. However, the most common fault is excess air, and in many cases this is caused by a leaky setting. All settings should be

plastered with one of the boiler-coating preparations on the market.

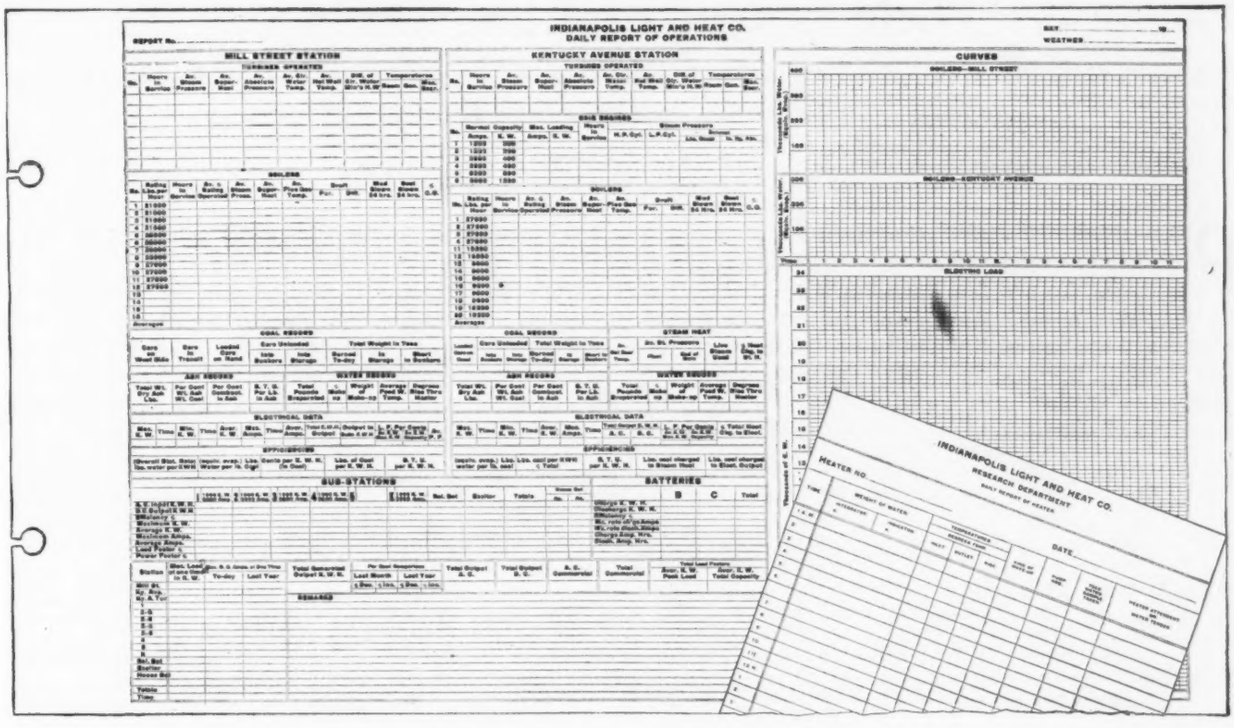
Measurement of CO_2 is important. A drop from 16 per cent to 10 per cent CO_2 means a waste of fuel of 5 per cent, while a drop from 10 per cent to 6 per cent CO_2 means 12 per cent loss of fuel, and a drop from 6 per cent to 2 per cent means 57 per cent loss of fuel. So there should be added to our list of instruments a CO_2 recorder. If it can be a continuous chart recorder, so much the better, but if it is a hand apparatus, let the sample of gas be taken when the fireman is not looking.

The instruments mentioned constitute those which are necessary for good economy in a boiler room. They should be bought and used honestly. Whenever they give the information that there is any improper condition inside the boiler setting, this condition should be remedied as soon as possible. The instruments should be calibrated and taken care of so that they will perform efficient service. If they are not taken care of, they are worse than useless, for they will lie. This list may be supplemented by others which are important but not absolutely necessary, such as the furnace temperature pyrometer, a coal sample grinder, apparatus for determining sulphur content, CO recorder, etc. It would be poor business to obtain certain results from day to day from these instruments without properly recording these results for future reference.

A form should be provided for daily boiler operation, and this form should include all readings of any value. The readings for each boiler should be taken simultaneously as often as conditions dictate. Care should be taken that the fireman does not allow his fire to drop down between readings.

Another form should be used for the heater and still another for the coal and ash. The heater form should show the inlet and outlet water temperature and the amount of water used. The coal and ash forms should show the weight of coal used and the weight of ash for a twenty-four-hour run. It should also show the kind of coal, where it is from, and how much is on the way. The amount of storage coal should be shown on the same sheet.

Another form to use is the maintenance form—one that includes the repairs made on boilers, stoker, brickwork and auxiliaries. This information will not only apprise the chief engineer of the repairs being made but will also give boiler hours on the equipment. It is a good thing to know how long a stoker can operate



FIGS. 4 AND 5—DAILY REPORT OF OPERATIONS AND HEATER REPORT

without entire replacement or which grade of firebrick lasted the longest under the same conditions. These results should, by all means, be consulted by the purchasing agent, since they not only give absolute data on the life of material but also allow him to anticipate his needs.

All these reports, together with those from other parts of the station, are collected at a certain time and consolidated into one station daily report. The best time for collecting these reports is midnight. From then until morning a clerk can consolidate the information and have the daily report ready for whoever desires it in the morning.

Thus the manager or chief engineer may look over this report for an hour in the morning and tell exactly how the station was operated for the previous twenty-four hours. He can tell what mistakes were made in operating, what apparatus needs attention, or the effect of changes made a day or two before.

A monthly report and a yearly report should be compiled. The monthly report gives the average re-

sults for a month and compares the month in question with the eleven preceding months. Such information as pounds of coal per kilowatt-hour, B.t.u. per kilowatt-hour load, pounds of water evaporated per pound of coal, etc., is contained in the report. These comparisons should be made in curves. The same outline applies for the yearly report.

Reports should not include useless information or too much detail. Be sure what readings or computations are desired, that these readings be taken and the computations made for every report. Also see that the final reports are looked over every day by the chief engineer and that he follows out whatever suggestions he receives from them. If this system is not followed out, it is obvious that the whole thing is useless, but if it is followed out, big dividends may be expected.

It may seem at first as if all this equipment will cost a prohibitive amount of money. There is no question that it will cost some money, but the investment is gilt-edged. The Indianapolis (Ind.) Light & Heat Company realized $50,000 saving the first year this system was put into force, and with coal and material prices as they are now the income from this investment this year will run over $100,000.

Selection of Lighting Units

Industries Wishing Maximum Production Should Observe Principles Outlined—Simple Method of Analyzing Distribution Curves Explained—Efficiency of Reflectors

BY DAVIS H. TUCK
Electrical Engineer Holophane Glass Company

PHOTOMETRIC distribution curves have a much more important meaning than is usually attached to them. To one familiar with their characteristics they give a good idea of the performance of the reflectors they represent. Therefore, in view of the close relation between industrial production and the illumination employed, an analysis of some of the common types of distribution curves may be of interest.

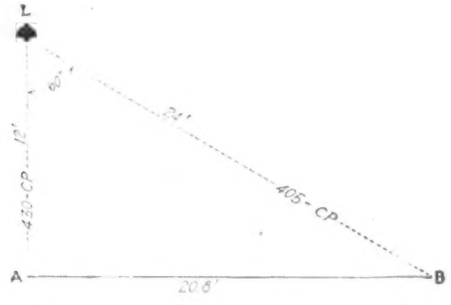


FIG. 1—FOR EQUAL ILLUMINATION AT POINTS A AND B THE CANDLEPOWER IN THE DIRECTION LB SHOULD BE GREATER THAN THE CANDLEPOWER IN THE DIRECTION LA

One of the first questions which arises is what form of distribution curve is desired for different classes of service. This can be answered for a specific case by referring to the law of inverse squares.* For example, if the reflector shown in Fig. 1 is hung 12 ft. (3.6 m.) above the floor, the illumination at point A directly under it would be $E = 430/12^2 = 3$ foot-candles. The illumination at a point B, 20.8 ft. (6.29 m.) away from point A, would be $E = 405/24^2 = 0.7$ foot-candle. However, the illumination of 0.7 foot-candle at point B (see Fig. 1) is the normal illumination or the illumination on a surface perpendicular to the line LB. In order to obtain the value of the illumination on a horizontal surface at point B, the normal value must be multiplied by the cosine of the angle of incidence (in this case 60 deg.), giving 0.35 foot-candle.

From the foregoing it may be seen that to obtain a uniform illumination over a horizontal surface the candlepower values represented in the distribution curve must increase at angles from the vertical to compensate for the decrease in illumination at these angles following the inverse-square law and the cosine law.

Another factor has to be taken into account in designing reflectors and adapting them to different light sources, and that factor is glare. It has been shown as a result of experiment and practice, and has been made the basis of the various state illumination laws, that high candlepower values at angles between 60 deg. and 90 deg. from the vertical produce glare, since it is light between these angles that enters the eye directly from the light source when looking at the work.

By considering this limitation, however, and applying the inverse-square and cosine laws it is possible to construct an ideal photometric distribution curve designed to give uniform illumination on a horizontal surface.

Referring to Fig. 1, the horizontal illumination at any point along the line AB is expressed by the formula $E = \text{cp.} \cos^2 x/h^2$, where E is the illumination on a horizontal surface at the point in question, cp. is the candlepower at the angle x, h is the height of the light source above the point where the illumination is ob-

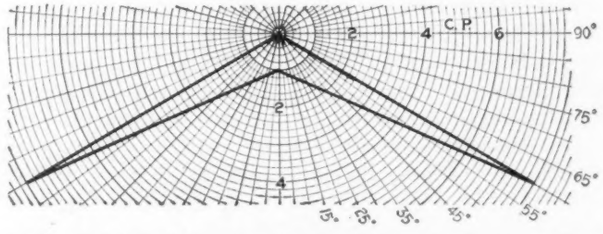


FIG. 2—THEORETICALLY IDEAL DISTRIBUTION CURVE TO PRODUCE UNIFORM ILLUMINATION

The sharp light cut off at 60 deg. eliminates glare. The candlepower values shown are relative and should be increased by a factor for the desired illumination intensity.

*Expressed by the formula $E = I/d^2$, where E is the illumination intensity, I is the candlepower and d is the distance from the light source having a candlepower I to the point at which the illumination is E.

tained, and cos x is the cosine of the angle between the vertical and a line drawn from the light source to the point where the illumination is measured. The candlepower required to produce this illumination is cp. $= Eh^2/\cos^3 x$. Eh^2 is a constant. Therefore, if a distribution curve be drawn (see Fig. 2) having the candlepower values proportional to $1/\cos^3 x$ for the various values of x, such a curve will represent an ideal photometric distribution curve for giving uniform horizontal illumination. At angles between 60 deg. and 90 deg. the candlepower should be zero so as to eliminate glare. Such a curve is shown in Fig. 2.

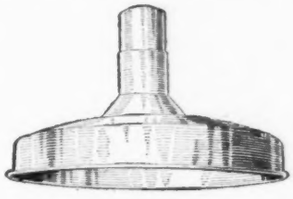
COMMERCIAL TYPES OF REFLECTORS

Commercial types of reflectors are made of porcelain enameled steel, silvered glass and prismatic glass. In Fig. 3 is shown a porcelain-enameled steel reflector of the shallow-bowl type, together with its distribution curve. To analyze the performance of this reflector from its distribution curve it is first of interest to note that the comparatively high candlepower values at angles greater than 30 deg. insure a high vertical component of illumination. The light cut off occurs at 75 deg. from the vertical instead of at 60 deg. as shown in the ideal curve (see Fig. 2). Some glare is therefore to be expected.

TABLE I—COMPARISON OF ACTUAL DISTRIBUTION WITH IDEAL FOR REFLECTOR IN FIG. 3

Angle, Degrees	Candlepower I	$\cos^3 x$	h^2	Illumination d†	Illumination E
0	430	1.0	144	0	3.0
5	440	0.988	144	1.0	3.0
15	460	0.901	144	3.2	2.9
25	460	0.744	144	5.6	2.4
35	460	0.549	144	8.4	1.75
45	470	0.353	144	12.0	1.15
55	420	0.188	144	17.1	0.55
65	390	0.075	144	25.2	0.20
75	285	0.017	144	44.8	0.03

† d is the horizontal distance from the light source to the point at which the illumination is taken (line AB; see Fig. 1).



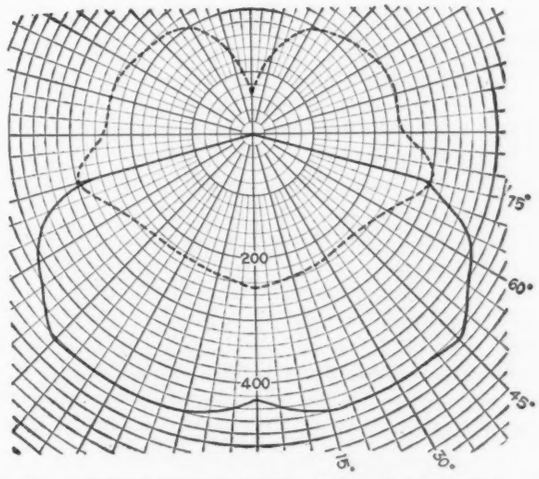


FIG. 3—A PORCELAIN-ENAMELED SHALLOW-BOWL-TYPE STEEL REFLECTOR WITH DISTRIBUTION CURVES

The dotted curve refers to a 200-watt type C lamp alone, and the full-line curve is for the lamp and reflector.

The next point of interest is to ascertain how nearly this distribution curve approaches the ideal as regards uniform illumination. Applying the formula $E = I \cos^3 x/h^2$, the mounting height being taken as 12 for this instance, a table should be constructed as in Table I herewith. From such a table it may be seen that the distribution curve of this reflector falls far short of fulfilling the ideal of uniform horizontal illumination (the ratio of maximum to minimum illumination being 100 to 1), although it may be suitable where this requirement does not obtain.

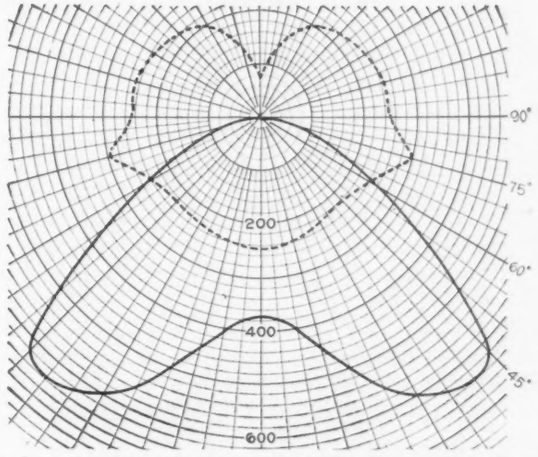


FIG. 4—A MIRRORED-GLASS DEEP-BOWL-TYPE REFLECTOR WITH DISTRIBUTION CURVES

The dotted curve is for a 200-watt type C lamp alone, and the full-line curve is for the lamp and reflector.

The next point of interest is to determine the efficiency of the reflector from its distribution curve. By the efficiency of a reflector is generally meant the percentage of the total lumens of the bare lamp that is contained in the 60 deg. zone, as this is the light that is useful for direct illumination. To obtain the number of lumens contained in any zone the average candlepower of that zone must be multiplied by the solid angle content of that zone. Table II gives values for comput-

TABLE II—EFFICIENCY OF REFLECTOR SHOWN IN FIG. 3

Zone	Average Cp.	Solid Angle Content of Zone	Lumens
0–10	440	0.0954	42
10–20	460	0.2834	130
20–30	460	0.4630	213
30–40	460	0.6280	290
40–50	470	0.7740	360
50–60	420	0.8970	380
Total			1415

Total lumens of bare lamp, 2800.
Per cent efficiency, (1415 ÷ 2800) × 100 = 53 per cent.

ing the efficiency of the reflector shown in Fig. 3 from its distribution curve.

From a study of the distribution curve of the reflector shown in Fig. 3, the following points of interest have been determined:

1. The reflector will give good illumination on vertical surfaces.
2. The reflector produces glare.
3. It does not give uniform illumination, the ratio of maximum to minimum being 100 to 1.
4. It has an efficiency of 53 per cent.

A silvered-glass reflector of the deep-bowl type, together with its distribution curve, is shown in Fig. 4. From an analysis of this distribution curve it may be seen that the illumination on vertical surfaces will not be so high as for the reflector shown in Fig. 3. From the standpoint of glare, however, the reflector shown in Fig. 4 will be better than the reflector in Fig. 3, as

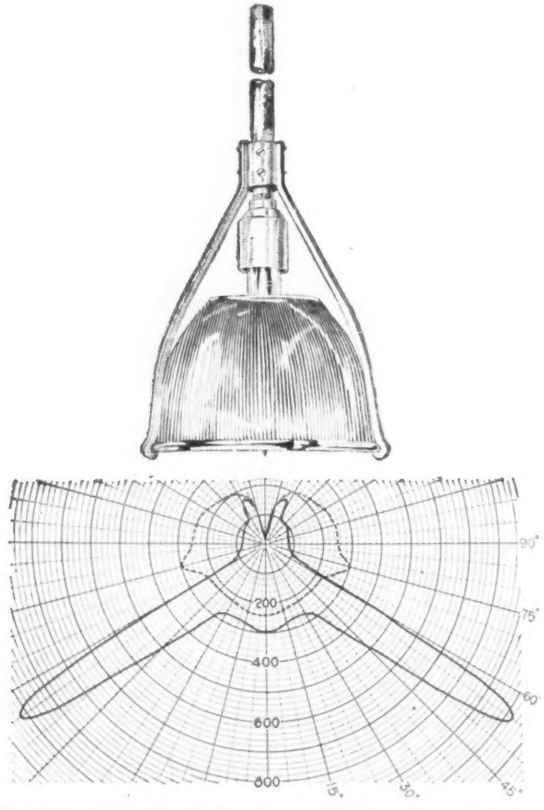


FIG. 5—A PRISMATIC-GLASS BOWL-TYPE REFLECTOR WITH DISTRIBUTION CURVES

The dotted curve is for a bare 200-watt type C lamp, and the full-line curve is for the lamp and reflector.

the candlepower values are not so high at angles between 60 and 90 deg.

From the standpoint of uniform illumination Table III, similar to the first one presented, shows that the spread of light is limited to 45 deg. and that between 0 and 45 deg. the illumination is uniform. As indicated, the ratio of maximum to minimum is 1.7 to 1. The efficiency of this reflector computed according to Table IV is 58 per cent.

A prismatic-glass reflector of the deep-bowl type, together with its distribution curve, is shown in Fig. 5. From a study of this distribution curve it may be seen that owing to the high candlepower values at angles greater than 30 deg. the illumination on vertical surfaces will be high. The sharp light cut off at 60 deg. insures practical prevention from glare.

From the standpoint of uniform illumination, Table V shows that the illumination obtained with the distribution curve in Fig. 5 is uniform between angles of 0 and 60 deg., the ratio of maximum to minimum being 1.7 to 1.

The efficiency of this reflector, computed in Table VI, is 61 per cent. It is to be noted, however, that the zone 90-180 deg. contains 587 lumens (or 21 per cent of the bare lamp lumens), which when reflected from the ceiling adds to the direct component of illumination in the form of indirect illumination. Thus from this reflector 82 per cent of the bare lamp lumens is useful, provided that the indirect illumination produced is kept at a high degree by proper maintenance of the ceiling.

When lighting units are selected for industrial use facts, not personal opinions, tinged as the latter may be with prejudice, should be considered. The distribution curves of competitive equipment should be studied as outlined and the selection based on the result of this study, together with other practical considerations, such as cost, mechanical strength, flexibility and maintenance.

TABLE III—COMPARISON OF ACTUAL WITH IDEAL DISTRIBUTION FOR REFLECTOR IN FIG. 4

x	I	$\cos^3 x$	h^2	d	E
0	375	1.0	144	0	2.6
5	380	0.988	144	1.0	2.6
15	444	0.901	144	3.2	2.8
25	560	0.744	144	5.6	2.9
35	626	0.549	144	8.4	2.4
45	626	0.353	144	12.0	1.5
55	351	0.188	144	17.1	0.4
65	181	0.075	144	25.2	0.09

TABLE IV—CALCULATION OF EFFICIENCY OF REFLECTOR IN FIG. 4

Zone, Degree	Average Cp.	Solid Angle Content of Zone	Lumens
0–10	380	0.0954	36
10–20	444	0.2834	126
20–30	560	0.4630	260
30–40	626	0.6280	394
40–50	626	0.7740	485
50–60	351	0.8970	314
Total			1615

Total lumens of bare lamp, 2793.
Per cent. efficiency, (1615 ÷ 2793) × 100 = 58 per cent.

TABLE V—SHOWING UNIFORMITY OF ILLUMINATION WITH DISTRIBUTION SHOWN IN FIG. 5

x	I	$\cos^3 x$	h^2	d	E
0	298	1.0	144	0	2.1
5	298	0.988	144	1.0	2.0
15	274	0.901	144	3.2	1.7
25	272	0.744	144	5.6	1.4
35	381	0.549	144	8.4	1.4
45	475	0.353	144	12.0	1.2
55	1026	0.188	144	17.1	1.3

TABLE VI—EFFICIENCY OF REFLECTOR SHOWN IN FIG. 5

Degree Zone	Average Cp.	Solid Angle Content of Zone	Lumens
0–10	298	0.0954	28.0
10–20	274	0.2834	178.0
20–30	272	0.4630	126.0
30–40	281	0.6280	176.0
40–50	475	0.7740	368.0
50–60	1026	0.8970	921.0
Total			1697.0

Total lumens of bare lamp, 2791.
Per cent efficiency, (1697 ÷ 2791) × 100 = 61 per cent.

Record of Electrical Men in Selling Bonds

How the Industry Has Organized and Applied Its "Power for Selling" in the Three Former Liberty Loan Campaigns

WITH the launching of the fourth Liberty loan now only one week off, the knowledge that in this campaign twice as many bonds as in the case of former loans must be sold and in three-quarters of the time comes home to every man. Plans for the active participation of every member of the electrical industry can be delayed no longer. It may assist these plans for greater individual selling in this fourth loan, therefore, to review the methods and experience which preceding bond campaigns have developed among electrical men.

The record of this industry in war service up to this time is a brilliant one. The best available statistics show total subscriptions to the first Liberty loan of $100,000,000, to the second loan of between $100,000,000 and $150,000,000, and to the third issue of probably between $150,000,000 and $200,000,000—an aggregate of $400,000,000. Add the total contribution to the Red Cross drives, the total sales so far of thrift and war savings stamps, and the total breaks probably near $500,000,000 which in a year and a half of war has been tendered to the government by electrical men as their share in financing the great world war.

The plan adopted at the Schenectady works of the General Electric Company shows to what length the work can be carried when such large bodies of employees are accessible. This organization was perfected for the second loan and has been made a permanent staff for the period of the war.

Here, to begin with, seven prominent men connected with the works were appointed as a Liberty loan committee, and they in turn established 100 sub-committees, each to have charge of the canvass in one or more of the departments of the works and general offices. The total number of members thus enlisted was about 1000, so that the entire staff was known as the "committee of one thousand." These committee men and women began immediately the canvass of their departments, working toward a Liberty Loan Day, when a special drive was scheduled. This day was posted and advertised. A large recording clock was placed at the main entrance to the works, to indicate progress, with smaller indicators for each department. This immediately inspired strong interdepartment rivalry.

During the week preceding Liberty Loan Day mass meetings were held each day during the noon recess, and on one occasion at midnight for the benefit of the night force. These gatherings were addressed by "G. E." speakers and prominent men of the city and reached audiences varying from 3000 to 6000 in number. On Liberty Loan Day the committee of one thousand gathered at the works restaurant, where luncheon was served at the expense of the company, and great enthusiasm was aroused by special speakers.

Then at 2 o'clock the members were sent into the shops to rake every nook and corner and gather in every possible signature. The total showed 92 per cent of all the employees subscribing.

Tremendous as the success of this campaign was, it is only typical of the effective effort which the electrical manufacturers have made. In the great works of the Westinghouse and Western Electric companies similar scenes were enacted with similar results. Smaller manufacturers applied the same keen selling methods to the limit of their opportunity. Shops were placarded, mass meetings held, pay envelopes carried strong advertising, and bonds were financed by the company so that employees could spread their payments over ten months or a year. Prizes were also offered for high records.

The jobbers have been no less active in their effort. In addition to helping and stimulating their own employees to buy bonds, they have found a field for usefulness in the utilization of their selling men both in canvassing their regular trade for bonds and as a team in the local city campaign. Much good work was done this way, and in more than one city we find electrical jobbers, as "generals" and "colonels," directing a large number of selling teams as a unit or in charge of districts of the city.

Central-station activity has followed this same direction, but naturally with an even closer contact in the local selling. Central-station salesmen have a wide acquaintance among the people and are wise in arguments to make the householder invest. How skillfully and eagerly they went into the canvass is well illustrated in the case of Brooklyn, N. Y. In the last campaign there the drive was inaugurated with a special meeting of the sales force in which their campaign was planned, and every member present, including office boys, subscribed on the spot. Definite instructions were then issued. Salesmen were not only to sell bonds but to work for the war in the broadest possible way.

Advertisements were featured in the newspapers. special window displays and billboard signs were installed, and a systematic canvass was made of every user of electric service, particularly in the industrial field. In addition, two Edison company crews were formed for night work, and these men, equipped with electric trucks and supported by brass bands and a detail of soldiers and sailors, addressed the evening crowds in theaters, restaurants and other public places and on prominent corners. Daily reports on the work of every man were posted in each company's office every day, and the work went on persistently until at the close of the drive $1,460,550 in Liberty bonds had been sold by this one central station.

Smaller companies followed out this same general plan in degree as their spirit, organization and opportunity permitted. They have taken the initiative in countless cities in forming teams of electrical men for house-to-house selling and for the sale of bonds within the industry. They have been most liberal in the financing of bond sales to their employees and invested heavily out of the company treasuries.

The electrical industry, therefore, has won an honorable distinction in its contributions to the first three Liberty loans. It is a measure and a precedent that will not be allowed to falter in the coming fourth Liberty loan campaign. Electrical men will be behind the government in this great drive.

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

SOME PRACTICABLE METHODS TO HELP IN SAVING COAL

Reminder of the Responsibility of Boiler-Room Operators in the War Economics--Practical Rules for Burning Coal

Just at this time, when the conservation of coal is an absolute necessity and every practicable suggestion for such conservation is a shot at our enemy, every one realizes that smoke issuing from boiler stacks represents unused heat units; but every one does not realize that certain simple rules, if observed in the fire room, will materially decrease this loss. The suggestions outlined below are based on many years' experience of the Westinghouse Electric & Manufacturing Company's combustion engineers:

1. Give your fireman an opportunity to acquire the fundamental principles of fuel burning.
2. If you have a difficult fuel problem, consult a combustion engineer.
3. Prevent smoke by proper firing methods.
4. Use gages to indicate exactly the condition of fire bed at all times. As a minimum these gages should consist of a draft gage indicating draft in furnace above fuel bed, a draft gage indicating draft at boiler side of flue damper, and a steam-flow meter for individual boilers.
5. CO_2 is the principal product of complete combustion of coal. From 10 to 12 per cent CO_2 should be obtained in flue gases to insure minimum fuel loss.
6. Avoid loss due to unburned coal in the ash.
7. If you are wasting exhaust steam, you are wasting coal.
8. Do not permit grates to clog. A systematic method of keeping the air spaces clean must be followed.
9. Inspect the baffles in boilers, as broken or leaky baffles raise the flue-gas temperature and waste coal.
10. Avoid leaking in of cold air around boiler setting.
11. Install stokers. Hand firing is rapidly being recognized as an obsolete and wasteful method of firing.
12. Clean scale from tubes, as every particle of scale wastes coal.
13. Avoid soot formation. All boiler tubes should be blown externally once every eight hours when in continuous service.
14. All smoke flues should be as short and straight as possible. Flues should also be made air-tight, and all joints and connections should be well fitted, calked and riveted. Use asbestos gaskets on clean-out doors.
15. Place flue dampers in front of boiler so that firemen will adjust them as required. Dampers placed in rear of boilers are seldom disturbed, regardless of their condition.
16. The size of coal has much to do with the capacity and efficiency of boilers. In general the air pressure penetrates the fuel bed formed by coarse coal more easily than that formed by finer coal, resulting in disturbance of best furnace conditions.

In addition to the above suggestions, the following "don't fail to do" list should be followed. Don't fail to:

Keep the heating surfaces of the boilers free from soot, scale or oil.

Keep the fires level and free from holes.

Do not carry the fires so thin as to draw a lot of excess air through.

Do not carry the fires so thick as to have incomplete combustion of the coal.

Do not soak the coal with water before firing.

Be sure the blow-off valves do not leak.

Do not have the safety valve popping off continually.

Cover steam pipes.

Do not waste steam through leaky valves or traps.

Never use live steam if exhaust steam is available and can be used as well.

An observance of the foregoing simple rules and suggestions should materially reduce the coal consumption of the average plant.

Buy Liberty Bonds Early

OPERATORS GIVE OPINIONS ON DEMAND METER PERFORMANCE

Different Types Discussed in a Critical Report Embodying the Experience of Meter-Men of Many Ohio Companies

Ten printed pages in the 1918 annual report of the meter committee of the Ohio Electric Light Association were devoted to demand meter performance. Troubles occurring in different types and remedies for these troubles were set forth in detail. Concerning those instruments operated by a solenoid or electromagnet which is controlled by a series of contacts with a moving member of the watt-hour meter the report had this to say:

"There are two parts to be considered in this type of measuring devices—the contacts and the indicating gears. The original contacts gave not a little trouble, for the material used in the manufacture of the cams would oftentimes carbonize, thereby closing the contacts at improper times, thus directly overmeasuring the demand. Moreover, rough spots could be found on them that would cause the contacts to chatter, this resulting in the same trouble. Both these difficulties were very objectionable. On the three-way contacts, such as are used in the graphometer and the type P, they sometimes get out of adjustment and weld together, this trouble generally resulting in the burning out of a potential coil.

"The later type of contacts now being manufactured are considerably more satisfactory. However, as long as contacts exist in connection with demand meters, there will always be some trouble. Therefore, they should be given occasional inspections, for it is always possible that dirt and dust will collect on them, or that they will otherwise get out of adjustment owing to inexperienced people meddling with them.

"Contact trouble is generally detected at the time of reading by suspicious-looking demands as compared with the normal registration of kilowatt-hours, or by an off-scale indication. Occasional inspection on this type of instrument is important, for at the time any suspicions arise the inspector can make an investiga-

tion of the contacts by examining them under a magnifying glass and checking their operation through complete revolution of the cam wheel. A thorough study of contacts should be made by men coming in connection with demand instruments, for there are a number of little details that can be watched and caught in time to save considerable annoyance to the company. Some companies report they are having all instruments and contacts removed and sent through the shop twice a year."

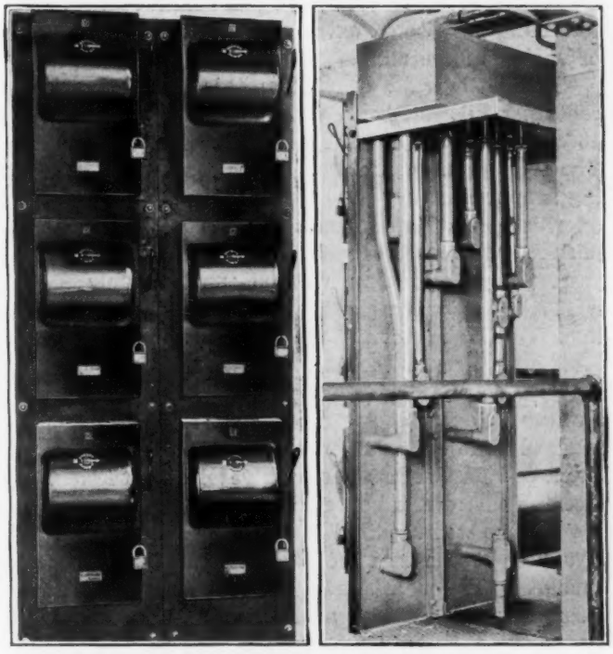
This discussion is typical of that found throughout the report, a complete copy of which may be secured from D. L. Gaskill, Greenville, Ohio. The committee in concluding its report states that while demand meters must still be regarded as being in the development stage they can be successfully operated under the vigilant care of trained inspectors who are always assigned to the same group of instruments.

Back Up Pershing's Crusaders

ACTUAL INSTALLATION COST OF INEXPENSIVE SWITCHBOARD

Industrial Plant Switchboard Controlling 150-Hp. Motors Built for 90 Cents per Horsepower Rating of Motors

Panelboards made entirely of angle iron and sheet metal and without slate are being installed at low cost by a number of electrical concerns on the Pacific Coast,



FRONT AND REAR VIEWS OF SWITCHBOARDS THAT DO NOT REQUIRE SLATE

as outlined in the ELECTRICAL WORLD for Aug. 31, 1918, page 400. Cost data on a type designed and recommended by F. L. Leurey of San Francisco have been compiled to show the inexpensiveness of these boards. They measure 18-in. (45.7 cm.) by 84 in. (203 cm.), and the average group consists of two or three panels. On the panels are mounted three triple-pole, single-throw, fused, 100-amp., 500-volt switches manufactured by the Square D Company, Detroit, Mich.

Each switch controls an average of 50 hp. in motors, and the total cost of erection with labor at $7 per day was $140 per panel. Therefore the average cost per horsepower of motors controlled would be $140 divided by 150 hp., or 90 cents. This cost includes the panelboard completely erected with all pipe connections made and wire installed. It does not include, however, the necessary sheet steel, condulets and angle iron used in the panel. These items are not estimated because they vary considerably in the different parts of the country and they represent only a minor part of the total expense.

TEACHING CABLE DUCT SPLICING TO NEW MEN

Each Man Before Being Permitted to Work in Manholes Must Successfully Make Splices in Imitation Manhole in Superintendent's Office

In order to be assured that new men are efficient and prepared to make good splices, the Duquesne Light Company of Pittsburgh, Pa., has arranged an imitation manhole in the underground department laboratory to allow the man to show his ability. This arrangement consists of half of a six-side manhole painted to appear like red brick and giving the man exactly the same amount of space as he would have if working under actual conditions. The work is watched by the superintendent or foreman of the underground department, and a man is not allowed to work in a manhole until he is fully qualified to make a neat splice and wipe the joint.

ASSURING CONSTANT VOLTAGE IN METER TEST DEPARTMENT

Use of Alternating-Current Synchronous Motor-Generator Set as a Means of Facilitating Testing Instruments

The maintenance of an absolutely constant alternating-current voltage is an important matter in the central-station meter department, if accurate tests are to be expected. Precision instruments show that in many cases the voltage variations on the alternating-current supply lines are so great as to require important test work to be done at night. By the installation of a 15-kva. synchronous motor-generator set the Hartford (Conn.) Electric Light Company has solved this problem so satisfactorily that tests can now be made on the assumption of constant alternating-current voltage even during the daytime and around such hours of load variations as 7 a.m. and 5 p.m. The unit, which is separately excited from the department's storage battery, was designed to provide for the future addition of a second generator when needed.

In case the frequency should vary during the test it can readily be adjusted by hand control at the field rheostat of the generator. Normally the frequency remains so nearly constant that even the sharp variations in system and feeder loads occurring at the hours above mentioned can barely be detected on a precision instrument.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

MAP WITH THE LOCATIONS OF PHYSICIANS POSTED

New York State Utility Has Prepared Against Emergency Map of City Showing Doctors' Residences and Telephone Numbers

In case of an accident calling for the immediate services of a physician there is likely to be confusion in summoning medical aid, and serious delay may result. If printed lists of physicians are posted in the plants or offices, as is the usual practice, the tendency is to call the first on the list. If such a list is not available, the person calling will summon the doctor whose name first comes to mind, and in either case little thought is given to the distance from the doctor's residence to the scene of the accident.

To eliminate this difficulty the Empire Gas & Electric Company of Auburn, N. Y., has prepared a map of the city drawn to a large scale and in a small white circle indicating the location of his residence or office has placed the name and telephone number of each physician, so that in an emergency a glance at the map enables the person calling to select physicians who can reach the scene of the accident quickly. In the margin of the map is a list of the company's officials who should be notified, together with their telephone numbers, and a list of the telephone calls for the hospital, fire and police departments. This method, while improving the efficiency of medical aid, also tends to distribute the calls more evenly.

Fire Liberty Bonds at Metz

SERVING THE COUNTRY CUSTOMER IN WAR TIMES

What One Middle Western Company Is Doing in Making Extensions to Farms and How It Justifies the Work

Running north from Berrien Springs, Mich., through a rather thickly settled farming community, is a newly built 9-mile (14-km.) extension to the system of the Indiana & Michigan Electric Company of South Bend, Ind. The line serves farmers only. It operates at 4400 volts, single-phase, and is constructed of 30-ft. (9-m.) wooden poles spaced on 150-ft. (45.7-m.) centers and carrying No. 6 copper wire. The line cost $11,800 and reaches 120 customers. To finance the line each farmer gave the company his promissory note for $102 before construction was started, with the understanding that the entire amount should be refunded in electrical energy at the rate of $1.50 per month. In all the company collected from the farmers $12,240, which it will have returned at this rate in about five and one-half years.

The average customer on this line has a ten-room house, each room of which is wired for electric light. The average cost of wiring and fixtures complete, ready to turn on the energy, was $70 for a ten-room house. The average connected load in a ten-room house on this line is 600 watts. In connection with this lighting load there will be more than fifty motors of 1 hp. or less, which will be used for pumping purposes. In such cases where the motor rating does not exceed 1 hp. in capacity it is attached to the regular lighting meter and adds nothing to the monthly minimum charge. There will also be a number of motor connections for units of larger capacity than 1 hp., and in such cases the motor will be put on 220 volts and a service charge of $1 per horsepower per month will be added to the energy charge. Practically every farmer along the line has signified his intention of wiring his barn and garage, so the total lighting load will soon amount to about 700 watts per customer exclusive of the motors. The 120 customers will be served from thirty-five transformers, in some instances as many as five customers being served from one transformer. It is interesting in this connection to know that where a farmer has a tenant house on his farm he can make connection to this building without extra cost to him except the cost of wiring the building.

The lighting rates charged on this installation are 11 cents per kilowatt-hour, with 1 cent discount, making 10 cents net with a $1.50 minimum charge per month. The average income for rural lines for residential lighting is approximately $150 per month, making an income on this line of approximately $2,160. When all appliances and stoves are on, as they will be within one year, the gross income will be approximately $3,500, which is approximately 30 per cent of the cost of the line. This, it is figured, will give the company the income it requires on the line. These rates and this financing plan do not include any provision for the long drop necessary to reach some farmhouses far back from the road. In the construction of the line the company allowed 300 ft. (91 m.) for each service connection. In case the customer's house was more than 300 ft. from the line, he was required to pay for all additional construction at the rate of $25 per 150-ft. span. The amount paid for this additional construction is considered as payment for a private line which is owned by the customer but maintained by the company.

The company's viewpoint on the situation, as explained by M. F. Caldwell, manager of the new-business department, is given in the following paragraphs:

"In serving the farmer life is made more pleasant for him, since electricity lessens his desire to go to the city in order that he may enjoy the city's luxuries. If the central station can meet these demands of the farmer, more food will be raised, and it takes food as

well as bullets to win the war. Moreover, after the war there is likely to be a period of readjustment in some of the country's industries that will cause a reduction in demand by some of the central station's power customers. With the farmer it is hardly expected that there will be such a period. The line which is built now will be paid for while the farmer is receiving top price for his goods and while is is easy to sell him electric service. Therefore, why not meet his demands now while he has the money and is willing to spend it? If he does not spend it for these improvements, he will spend it for something else which will perhaps do him less good, and the central station will lose an opportunity to get his business and to keep him satisfied on his farm raising food for the nation.

"In cases where a careful survey shows that the line would give insufficient revenue to pay a reasonable profit on the investment, the company believes that sufficient of the farmer's deposit should be retained to reduce the investment to a figure which the revenue from the line will justify."

He Also Fights Who Buys Liberty Bonds

APPLIANCE REPAIRS CAN BE HANDLED BY WOMEN

In Four Weeks Boston Company's Maintenance Department Effected 447 Repairs with Excellent Results

Repairs on lamp cords, electric irons and other appliances are being made by a young woman maintainer with excellent results at the Head Place offices of

GIRL REPAIRER HANDLING ELECTRICAL EQUIPMENT

the Boston (Mass.) Edison company. This work was formerly done exclusively by men, but the inroads of the war led the company to try the experiment of utilizing feminine hands and eyes in getting such equipment into shape for use as quickly as possible.

The accompanying illustration shows the maintainer in the act of removing the heating element of a General Electric iron from the terminals prior to inserting a new element. This young woman had never had any previous mechanical or electrical experience prior to joining the staff of the Edison company last spring. She was employed for three weeks in filing requisitions in the company stock room at the General Service Buildings and was then given about a week's instruction in appliance repairing at the Head Place office. From Aug. 1 to Aug. 27 she effected 447 repairs on appliances, the maximum number per day being thirty-four. The hours are from 8:30 a.m. to 5 p.m., except on Saturdays, when the repair department closes at 1 p.m.

SMALL-TOWN APPLICATION FORM FOR ELECTRIC SERVICE

Simply and Directly Stated with the Terms and Conditions of the Service Printed on the Reverse Side

The Warrenton (Va.) Electric Light & Ice Company has drafted a form for application for electric service which M. J. O'Connell, manager of the company, submits as appropriate for small communities. In drawing up the form the company found it very difficult to obtain such forms except from companies operating in large cities. Warrenton has a population of 2500 people.

The front of the application, which is 11 in. by 8½ in., is here shown and, as will be noticed, is worded in simple, direct language. On the reverse side are the terms and conditions.

Number.....

APPLICATION FOR ELECTRIC SERVICE

TO

THE WARRENTON ELECTRIC LIGHT AND ICE COMPANY

WARRENTON, VIRGINIA.

.....19.....

(1.) I hereby make application to The Warrenton Electric Light and Ice Company for electricity to be supplied to the premises.....

occupied as.....for.....

purposes and agree to take service for.....months, subject to the terms and conditions endorsed hereon, and made a part hereof.

(2.) I agree to pay for electricity used at the schedule of rates filed by the Company with the State Corporation Commission, Richmond, Va., a copy of which is acknowledged.

(3.) I agree to pay all bills promptly when due.

(4.) I agree to be responsible for all electricity used on said premises until 48 hours after written notice has been given the Company at its office, to discontinue the supply.

(5.) I agree that the agents of the Company shall have free access at any reasonable time to its appliances on said premises; and may remove meter for any purpose, providing other provisions are made for continuing service; and upon failure to comply with any rule of the Company, the Company may disconnect its service, upon 3 days written notice.

(6.) I agree to make a deposit of $.....if required. I further agree that my deposit may be retained and applied by the Company upon bills or any indebtedness whatsoever. For such time as said deposit may be idle, because of not being applicable to any debt due the Company, it shall draw interest at the rate of 5 per cent.

(7.) I agree that no changes shall be made in the equipment specified above, that no other electric service shall be introduced, or used in connection with the equipment supplied hereunder, without the previous written consent of the Company.

Signed.....

Approved for the Company .....

.....

General Manager

NOTE. As used in this application, the term "The Company" in each instance refers to The Warrenton Electric Light and Ice Company.

(OVER)

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Installing Electric Motors.—A. CURCHOD.—The author examines all the types of direct-current and alternating-current motors that are in practical use and explains the starting apparatus in detail, showing how to make connections both to the motor and to the lines.—*Revue Générale de l'Electricité*, Aug. 3, 1918.

Lamps and Lighting

Improved Lighting of Automobile Manufacturing Plants.—F. H. BERNHARD.—High production and high efficiency of manufacture have required adequate and correct lighting schemes in the automobile industry. It is pointed out in this article how good lighting pays for itself, and attention also is called to some features that need special improvements.—*Electrical Review*, Aug. 10, 1918.

Project for Standardizing the Threading of the Bottoms and Supports of Edison Lamps.—CH. ZETTER.—A very elaborate article on efforts made in this direction in France, embodying the report made by the author in collaboration with M. Chalicarne, engineer, and M. Saquet, designer, to the Union des Syndicats de l'Electricité.—*Revue Générale de l'Electricité*, July 6, 13, 20 and 27, 1918.

Generation, Transmission and Distribution

Creation of an Artificial Neutral Point in a Monophase or Three-Phase Network.—L. DUBAR.—In some installations it is convenient to have two separate voltages—one for motor service, the other for lighting. With alternating current, monophase with two circuits and three-phase with four wires are often used; but it may happen that the transformers have no neutral point accessible, or, in the case of three-phase distribution, that they have their secondaries delta-connected. In such cases it is necessary to make an artificial neutral point with the aid of balancers. The author studies these apparatuses and their performance when charged with electricity and when not so charged. He propounds a theory applicable to all polyphase distributions, but particularly to the monophase and three-phase which are the most employed. Some observations upon six-phase balancers are also included.—*Revue Générale de l'Electricité*, Aug. 3, 1918.

Calculations of High-Tension Cables.—The complex method of calculating high-tension cables has the defect of not being easily capable of physical interpretations. The results are now put into a form in which the superposition of the no-load and short-circuit conditions can be clearly seen.—*Science Abstracts, Section B*, June 29, 1918. (Abstracted from *Elekt. Zeits.*, Feb. 28, 1918.)

Predetermination of Generating Costs.—The economic problem of central stations is to secure maximum surplus of receipts over expenses, this surplus being a complex function of the selling price per unit. Reducing the selling price results in increased sales, and this in turn reduces generating costs. The difficulty is to predetermine the reduced generating costs so that the lowest selling price which will yield a sound return may be ascertained with reasonable accuracy. There are too many variables to permit of an exact mathematical solution to the problem, and in particular the increase in connections resulting from decreased price per unit is indefinite. By making various assumptions it is possible to obtain linear relations between certain variables and to express others by rectangular hyperbolic functions. Klingenberg has evolved a means of predetermining working costs, assuming equal generating units, but the author's method covers the perfectly general case (with unequal sizes of generating units) and permits costs to be evaluated for a number of years ahead. A tariff suited to the desired or anticipated development can thus be framed with considerable accuracy.—*Science Abstracts, Section B*, June 29, 1918. (Abstracted from *Elekt. Zeits.*, March 28, 1918.)

Installations, Systems and Appliances

Electric-Winding Engines and Mine Hoists.—H. H. BROUGHTON.—The author deals with the technology of the electric winding engine or mine hoist. In this article, which is the first of the series, the scope of the work is defined, and notes of general interest are given on the question of power supply.—London *Electrician*, July 5, 1918.

Briquetting of Lignites.—R. A. ROSS.—This paper contains an outline of the fuel situation in Canada, with specific recommendations concerning the procedure to be followed in briquetting lignites.—*Journal of Engineering Institute of Canada*, August, 1918.

Electric Heating; Some Practical Experience.—E. R. SHIRLEY.—The author puts down the principal advantages of electric heating. He then discusses the results of electric heating in a house of certain definite description for which test data had been gathered. From the results of considerable data of this sort be also discusses the possibility of using electrical energy for heating in a city with a population of 22,000.—Toronto *Electrical News*, May 15, 1918.

Lift Controllers and Controlling Gear for Direct-Current Lifts.—In this article, which is one of a series, the writer discusses the car-switch control by means of which the attendant controls the elevator by having three switch positions—up, down and off. This method may be applied for high-speed elevators by having, in addition to the above, two extra steps, slow-up and slow-down. In another method, by means of push-button control, the attendant may be dispensed with and the elevator becomes automatic in operation.—London *Electrician*, July 19, 1918.

Reconstruction in Germany and Austria.—Proposals for the centralization and development of electric power supply in Germany have received a great deal of attention, and various schemes have been put forward. Reform of the present system has been urged on four grounds: (1) Economy in coal and its transportation; (2) the possibility of using a state monopoly of electricity and of coal as a source of revenue; (3) the importance of plentiful and cheap power in industrial reconstruction, especially in the development of the electrochemical and electrometallurgical industries; (4) the necessity of exploiting all the water-power resources of the country.—London *Electrical Review*, July 26, 1918.

A New Method for Separating Slate from Coal.—H. M. CHANCE.—The author presents the subject in the following order: (1) Various devices used for separation of slate from coal; (2) difficulties arising under these methods; (3) imperfect separation, loss of product, high unit costs; (4) new method of effecting separation by use of an agitated mixture of sand and water constituting a fluid mass of relatively high specific gravity, in which the coal floats and the slate sinks; (5) application of this principle to other ore-dressing problems.—*Journal of Engineers' Club of Philadelphia*, August, 1918.

Electrophysics and Magnetism

Characteristic Curves and the Conditions of Operating Stability.—J. BETHENOD.—A supplementary note to an article by the same author on the spontaneous occurrence of oscillatory phenomena in electrical circuits, with particular reference to the singing arc of Duddell (*La Lumière Electrique*, Oct. 14, 1916). The short article under present notice takes up the case of a particular arrangement and studies the resulting phenomena.—*Revue Générale de l'Electricité*, July 13, 1918.

Proposed Revisions in Tests for Magnetic Properties of Iron and Steel.—According to a paper presented recently before the American Society for Testing Materials, the standard data for material intended for permanent magnets should consist of the normal induction (B), the normal residual induction (B'), and the normal coercive force (H_c) corresponding to a magnetizing force of 200 gausses. Standard magnetic data shall be determined by the Burrows compensated double-yoke method on test specimens prepared as indicated below. Each mill heat or lot shall be marked separately. The test sample shall consist of one test specimen from each of six different bars. The test specimen shall be 25 cm. (9.84 in.) or more long and shall be of such cross-section that it will pass through a rectangular tube whose cross-section is 2 cm. by 5 cm. (0.79 in. by 1.97 in.). The heat treatment prescribed follows: Heat the specimen to 825 deg. C. (1517 deg. Fahr.) and quench in water at 20 deg. C. (68 deg. Fahr.) for steels of the following approximate chemical composition: Carbon, 0.50-0.70 per cent; manganese, 0.50-0.51 per cent; phosphorus, 0.05 per cent; sulphur, 0.03 per cent, and silicon, 0.10 per cent. For tungsten steel heat specimen to 845 deg. C. (1550 deg. Fahr.) and quench in water at 20 deg. C. For other alloy steels the heat treatment is to be determined by practical tests on the test specimen. The furnace shall be of such size that the specimen is heated to the required temperature in not more than thirty minutes. The furnace temperatures given above shall not vary by more than 10 deg. C. On quenching, the test specimen shall be removed quickly from the furnace. The test specimen shall not be allowed to cool over 10 deg. C. (50 deg. Fahr.) after leaving the furnace and before immersion. Immerse end-on or edgewise. The quantity of water shall be such that after quenching it is not over 50 deg. C. (122 deg. Fahr.)—Extracted from paper presented before American Society for Testing Materials.

Units, Measurements and Instruments

Hysteretic Losses in Iron.—MARIUS LATOUR.—Supplement to an article printed in the *Revue Générale de l'Electricité* for April 13, 1918, upon hysteretic losses in sheet iron at high frequencies. The author determines the relation that exists between the hysteretic angle τ and the coefficient τ_i of Steinmetz, showing that the exponent n, habitually valued at 1.6 in formulas giving hysteretic losses, is necessarily equal to or greater than 2 for inductions of more than 1000. In cases where the induction oscillates between two values of the same sign the coefficient τ_i must be multiplied by a certain factor.—*Revue Générale de l'Electricité*, July 13, 1918.

Miscellaneous

Tungsten.—DÉSIRÉ PECTOR.—A continued article on the production and characteristics of tungsten, with comprehensive details of its employment in the electrical industry.—*Revue Générale de l'Electricité*, July 20 and 27, 1918.

New Materials in the Electrical Industry in Germany.—S. FRID.—Although copper remains indispensable for many applications, the Germans have made much progress with substitutes. For copper conductors three substitutes have been tried with fair success—iron, a compound of iron and zinc, and a compound of iron and aluminum. Manganin and iron, as well as liquid rheostats, have been substituted for copper ones. Busbars have been made of iron, zinc, electron and magnesium. Paper has been used for insulation and for belting, steel bands have also been used for belts, oil of graphite and a potassic solution for lubrication, and many other replacements have been tried. A comparative estimate of metallic values is given, according to the following table:

	Conductance	Density	Point of Fusion in Deg. C.	Coefficient of Expansion per Deg. C.
Copper	57,0	8,9	1084	$1,7 \times 10^{-5}$
Aluminum	32,7	2,7	657	$2,2 \times 10^{-5}$
Magnesium	22,0	1,7	650	$2,2 \times 10^{-5}$
Zinc	16,0	7,2	430	$3,0 \times 10^{-5}$
Electron, cast	16,0	1,8	620	.....
Electron, compressed	16,0	1,8	620	.....
Iron	7,0	7,8	1400	$1,2 \times 10^{-5}$
Steel	5,8	7,7	1350	$1,2 \times 10^{-5}$

—*L'Industrie Electrique*, June 25, 1918.

Distribution of Copper Ores.—This circular, which is now ready for distribution, describes the distribution of copper ores in the earth's crust, the different kinds of copper ores, the metallurgical process of extracting metallic copper, the effect of impurities in copper, the electrical and mechanical properties, the physical characteristics, and the welding and hardening of copper.—*Circular No. 73*, Bureau of Standards.

Scientific and Industrial Research

(PRINTED IN THE THIRD ISSUE OF EACH MONTH)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Coöperative Work.

Conducted by PROF. VLADIMIR KARAPETOFF

Cornell University, Ithaca, N. Y.

Research in Progress or Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Technical Theory and Practice" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

CABLES, INSULATION TEST.

Additional information is being obtained on the characteristics of insulating compounds. It has been found that cable insulated with mineral-base compound will not withstand a high insulation test when cold, as the insulation resistance is much reduced under such conditions. All this complicates the problem of preparing standard specifications.—*A. I. E. E. Committee on Transmission and Distribution.*

CEMENT INDUSTRY, ELECTRICITY IN.

A sub-committee on the cement industry has tabulated all the processes involved from the point when the raw product is brought to the cement plant up to the point when the finished product is delivered, barreled and ready for shipment. Each process may be considered a movement of some kind. Where electric power is applied to this movement the preferred type of motor control and accessories and alternates are indicated.—*A. I. E. E. Committee on Industrial and Domestic Power.*

CONDUCTORS, SKIN EFFECT.

Skin effects in massed bars, such as are used in electric furnaces involving very large current, are being determined. Dr. Kennelly has published some very interesting experimental work along this line, and it would be interesting if others who have been experimenting with low frequency would publish the results of their measurements.—*Dr. Ernst J. Berg, Union College, Schenectady, N. Y.*

INDUCTANCE COILS, HIGH-FREQUENCY RESISTANCE OF.

The writer has compiled information on the usual methods of measuring this quantity, in which he calls attention to the weak points, if any exist, and develops equations for relations that exist where the distributed capacity may be ignored. The error which may attend this assumption of no distributed capacity in some cases is emphasized.—*C. S. Ballantine, Philadelphia.*

INSULATORS, EFFECT OF TEMPERATURE CHANGES.

Extensive tests are being conducted on the aging effect on insulators carried through a large number of temperature cycles corresponding to the daily and seasonal variations experienced in practice.—*Harris J. Ryan, Stanford University, California.*

INSULATION, LIQUID.

The sub-committee on tests of liquid insulation reported that an elaborate series of tests had been prepared and were being worked out in four different laboratories but were not yet in form for presentation.—*Committee on Electrical Insulating Materials of the American Society for Testing Materials.*

INSULATING VARNISHES.

Tentative specifications have been worked out for the testing of insulating varnishes, and will be given as thorough a trial this year as possible by the members of the committee and others who may be interested.—*Committee on Electrical Insulating Materials of the American Society for Testing Materials.*

SKIN EFFECT IN TUBULAR AND FLAT CONDUCTORS.

An extension of the previous work by various authors. Theoretical formulas have been deduced for the increase in resistance due to a non-uniform distribution of alternating-current density. The formulas check quite closely with a few available experimental results. A complete account of this investigation is published in the August *Proceedings* of the A. I. E. E.—*H. B. Dwight, Hamilton, Ontario.*

THERMO-ELECTRICITY, POSSIBILITY OF REFRIGERATION.

A theroretical investigation is being made into the efficiency of a refrigeration process based on the Peltier effect. It is well known that when a current passes through the junction of two metals a reversible heat phenomenon takes place. For example, when the current flows from antimony to bismuth heat is produced at the surface of contact, while heat is absorbed when the current flows in the opposite direction. Thus such a junction may be made to act as a refrigerator and in a familiar experiment ice is actually formed around the junction by placing it in cold water. The purpose of the present investigation is to deduce the most favorable conditions of operation and to determine the highest attainable efficiency on the basis of some late research into the Peltier effect.—*A. W. H. Griepe, New York City.*

Suggestions for Research

AIR WASHERS FOR LARGE TURBO-GENERATORS.

In many cases the distance between spray particles is equal to hundreds of diameters of each dust particle, even with extremely fine sprays in the densest spray washers now built. A thorough realization of this condition will make it apparent that with density of spray alone, no matter how great, one cannot hope to produce an efficient washer, although it will help. On the other hand, the method of directing the spray with respect to the path of the air is of first importance, and the future successful washer will probably be built with this consideration in view.—*C. B. Humphrey, American Spray Company, New York.*

ALTERNATING CURRENTS, HARMONIC ANALYSIS OF.

The Braun-Ryan cathode tube, which has been used as a wattmeter (see articles in the A. I. E. E. *Transactions* by Minton and others) may be set up to measure harmonics by selective resonance. With known variable frequency and a constant-frequency alternating current which one wishes to analyze, it may be possible to get readings from which the amplitude of any harmonic may be determined.—*R. E. Bitner, Cornell University, Ithaca, N. Y.*

CORE LOSS, REDUCTION BY HIGH-FREQUENCY MAGNETIZATION.

It has been demonstrated by various investigators that the hysteresis loop of a specimen of steel may be made considerably narrower—that is, the loss reduced—by subjecting the specimen to a high-frequency magnetization at the same time that it undergoes a low-frequency hysteresis cycle. The effect seems to be the same as if the molecules were rapidly shaken and made less sluggish. In a piece of apparatus like a large transformer the core loss may be the limiting factor in determining the size of the core. If by means of high-frequency currents the loss could be considerably reduced, higher flux densities might be used. As a result the core would be smaller and the mean length of turn also reduced, bringing an added economy in the weight of copper. An investigation is desired of the possibility of such a method for practical use.

INSULATION TESTS ON APPARATUS IN SERVICE.

The following questions were recently asked of operating companies in the N. E. L. A. Question Box: (1) What companies apply potential tests to the insulation of their generators and other similar apparatus? (2) How frequently is such a potential test applied? (3) What test voltage is applied (measured in terms of normal operating voltage)? About eighty replies were received, but only five large companies reported periodical potential tests. For details of these replies see *N. E. L. A. Bulletin*, March, 1918, p. 185. In this connection, S. C. Lindsay, of the Puget Sound Traction, Light & Power Company of Seattle, suggests that each time it becomes necessary to rewind any generating or transforming apparatus tests to destruction be made in order to determine the strength of the insulation before the winding is removed for the purpose of putting on new. If this could be done every time a machine is rewound, it would result eventually in the collection of a valuable amount of data.

TEMPERATURE RISE.

Resistance thermometers and thermocouples are available for measuring temperature rise in the stationary parts of electrical machinery. It would be very desirable to develop a device to indicate the temperature rise in a revolving part of a machine in actual operation. There should be no slip rings for carrying the indicator current to the switchboard or to an alarm. For example, the current generator in a thermocouple may be used to excite small electromagnets attached to the revolving part. The magnetic fluxes so created may be used to induce currents in a stationary armature, and these currents, amplified if necessary, may be made to actuate an indicating or recording instrument or an alarm.—*Editorial Suggestion.*

THESIS SUGGESTIONS.

Many items suggested by various contributors in the Research Section are particularly well suited for thesis work of students in colleges of engineering. Some professors state that these suggestions would be much more valuable if the writers would not only indicate the results desired but also outline in detail the method of procedure. Actual experience shows that a general statement of a problem is not sufficient for a beginner and he is liable to lose considerable time in finding out exactly what is desired.

[Persons who are equipped to take up such research should communicate with the person suggesting it for details since space in these columns does not permit our giving them.—*Editor* ELECTRICAL WORLD.]

TRANSFORMER OPERATION AT TEMPERATURE OF LIQUID AIR.

It is desired to investigate economies that would result from the operation of a large power transformer at the temperature of liquid air or thereabouts. Such an arrangement is by no means impracticable, since liquid air could be circulated in pipes or even perhaps used as insulation. At such a temperature the resistance of copper is but a fraction of its value at ordinary operating temperatures, so that much higher copper densities could be used, thus reducing the weight of copper and the length of the mean turn. The size of the core would consequently be reduced, and, moreover, higher flux densities could be safely used.—*Editorial Suggestion.*

TRANSMISSION LINES, CHARGING CURRENT.

In the operation of a high-voltage, 60-cycle rural transmission line fed from comparatively small generators, the charging current has often been found to constitute quite a large percentage of the full-load current of the generators. This condition makes a constant-voltage operation rather difficult and the regulation is very poor. Some of the smaller companies have bridged across the generator busbars reactances taking exciting currents comparable with the charging current drawn by the transmission line. This practically reduced the demand upon the generators to the actual load current and should improve the operation materially. An investigation of this method of operation would be of considerable interest to the transmission-line companies operating in sections of the country, like the Middle West, where the population is comparatively scattered though prosperous.—*V. L. Hollister, University of Nebraska, Lincoln.*

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

BALTIMORE WARNING OF "POWERLESS DAYS"

President Herbert A. Wagner Tells Consumers of the Consolidated Company to Prepare for Probable Contingencies

"Powerless days" are possible in Baltimore, and notice to this effect has been sent to large power consumers by president Herbert A. Wagner of the Consolidated Gas, Electric Light & Power Company. The notice was issued for the purpose of preparing customers for probable contingencies. At present the company has enough power to supply all needs.

Mr. Wagner expresses himself as sure of the co-operation of consumers. He says in his notice to the consumers:

We are very sorry to have to inform you that we are threatened with a shortage of electric power as we approach the time of year when the amount of power obtainable from the Susquehanna River is small on account of low water flow.

It has been our fixed policy to make every effort to anticipate the power demands of the community long enough in advance to assure the delivery and installation of sufficient machinery to supply all requirements without any aid whatever from the Susquehanna River. In line with this policy we ordered in October, 1916, two 20,000-kw. (52,000-hp.) steam turbines and generators as an addition to our power plant. These were scheduled for delivery in February and March of this year. Owing to war needs and government control of steam-turbine production, and in spite of the highest priority, giving us preference over all other public utilities, the delivery of these machines has been delayed and cannot be made before October next. We are therefore doing our utmost to supply the service needed by our customers with more than 50,000 hp. less generating capacity than we expected to have at this time.

It is possible that we may be able to pull through without curtailing our service to you, but if we find the demand becomes greater than we have ability to supply, we must count on your coöperation to reduce your consumption of electrical energy to the amount which we find necessary upon twenty-four hours' notice. It is our intention to distribute this reduction among all our industrial customers on the basis of a percentage of the demand of each, but if we find our requests for such reduction are ignored, we shall have only one alternative, and that is to supply power to consumers only in rotation on a schedule which will deprive each consumer of all power whatsoever for one or more days in each week. In anticipation of this we have divided our power consumers into groups and have placed you in the group which will, in the event of a shortage of power, have the power supply cut off entirely from 6 a. m. until 6 p. m. on —— of each week, as long as the deficiency shall continue.

We wish to accomplish the utmost conservation of power with the least inconvenience to our customers and, in the event of shortage, we will notify you what reduction is required and will only resort to the "powerless day" schedule in the event that our requests are not complied with, in which case power will be cut off on the weekday specified without further notification.

We cannot tell you at this time when the call for power reduction may be necessary, but when or if it comes you will receive at least twenty-four hours' notice. We are writing you now merely to advise you of the conditions which are threatening us.

Ring the Liberty Bell—Buy Bonds

HITCH IN CONGRESS ON THE WATER-POWER BILL

Legislative Complication in the Senate Endangers the Prospect of Early Action on the Much-Needed Law

The prospect that there might be action in the near future on the water-power bill in Congress has apparently been lessened, according to the Washington representative of the ELECTRICAL WORLD.

A legislative situation has arisen in connection with the measure which at the same time involves the prospect of early action by Congress on the emergency power act under which $200,000,000 would be appropriated as a war measure for the creation of additional power facilities. Before this is published it is possible that some action will have been taken by the Senate on the water-power bill. The measure will in all likelihood be committed to conferees for the Senate and the House.

But a new element has entered into the legislative situation concerning both the water-power bill and the emergency power act. Senator Thomas of Colorado, who has been endeavoring for some time to have passed by Congress certain legislation which would encourage and promote in his opinion the mining of coal, phosphate, oil, gas and sodium, and who has been unable to obtain the legislation he has desired in the form in which he advocates it, has given notice in the Senate that he intends to offer his legislation as an amendment to the water-power bill. This proposal will still further complicate the legislation proposed in the water-power bill because all Senators who where originally opposed to Senator Thomas' legislation would be opposed to the water-power bill if it came before them with Senator Thomas' legislation attached to it.

The fate of the emergency power act is involved in this situation, because Senator Shields, to whose committee the emergency power act will come from the House of Representatives, has informed the Washington correspondent of the ELECTRICAL WORLD that he doubts if his committee will be able to take up the emergency power act until the water-power bill is out of the way. The prospect, therefore, is for a long parliamentary delay on both bills on the Senate side.

In the meanwhile the House committee on interstate and foreign commerce has been whipping the emergency power act into shape to report it to the House as soon as the revenue bill is passed by the House.

Dr. H. A. Garfield for $200,000,000 Power Law

United States Fuel Administrator Urges Upon Congressional Committee the Importance of Passing the Emergency War Plant Act to Provide Adequate Power Supply for Coal Production

ANOTHER reason for the passage of the two-hundred-million-dollar emergency power act has been advanced before the committee on interstate and foreign commerce of the House of Representatives by Dr. H. A. Garfield, United States Fuel Administrator, who sees in the measure the promise of a more adequate supply of power for coal mining and, furthermore, economy through the substitution of central stations for isolated plants in coal mining.

WHY DR. GARFIELD SUPPORTS THE BILL

Dr. Garfield, in testifying before the committee this week, said that the bill appeals to him as one which ought to be enacted into law for several reasons. An adequate supply of power is essential to maintain the full and reliable production of coal. There are several sections of the country where the coal supply is of particular importance, those sections being especially the regions furnishing the by-product coal which is essential to steel making and without which the whole war program must halt. In all of the regions where the central power plant has been introduced a difficulty has arisen because of the fact that the overloading of the central plant by reason of the large increase in requirements due to the war has resulted sometimes in a breakdown of the plant, at other times in a failure to furnish power for continuous operation.

Dr. Garfield said that the chief reason why the companies involved do not increase their plants is, he is informed, that the financing of the war by the government made it virtually impossible to raise the necessary amount of capital at the present time.

The regions where there is the greatest need are in general these, said Dr. Garfield: First, western and central Pennsylvania; second, the eastern Ohio coal fields; third, the central Illinois fields; fourth, the western Virginia fields; fifth, the eastern Kentucky fields.

Adequate power systems are essential for the use of coal for power service to industrial undertakings.

"In a general way," said Dr. Garfield, "there is a saving in the cost of operation of something like two and a half times by the installation of these central plants, but I take it that your committee is not particularly interested in that, inasmuch as that saving comes primarily to the mining companies that utilize the central power instead of making their own power. You are interested particularly—at least we are—in the amount of coal saved, and it is from two to four times in quantity. Indeed, in the anthracite regions where the situation is somewhat peculiar we have figures that enable us to speak, not as from an estimate, but with much more accuracy than that. There is a saving of nine times the quantity of coal. Now at a time like this, when we are so pressed upon for additional coal, that saving is of the utmost importance."

Chairman Sims—You mean utilizing the coal in these large stations would result in a large economy of coal, amounting to the figures you have just mentioned?

Dr. Garfield—Yes. Speaking of this anthracite illustration, to mine 90,000,000 tons of anthracite coal requires in the isolated plant 9,000,000 tons of coal, which must be burned up at the mines; and I say it is better than an estimate, because it is in part based upon their experience, that if they were able to utilize power from a central plant for their mines, only 1,000,000 tons of coal would be used in producing 90,000,000 tons.

Chairman Sims—By the use of one power plant instead of a power plant at each mine?

Dr. Garfield, answering in the affirmative, gave particulars of one plant in which only one-fourth of the amount of coal is consumed in supplying the energy that was formerly used when the mine ran its own plant and generated its own energy. Continuing, Dr. Garfield said:

"The difficulty at the present time is that these central plants which are established here and there, because the movement was well under way before the war began—the economy of it being obvious to everybody interested in the industry—the difficulty is that with the overload now on these plants there are breakdowns that lay up the coal production."

"There are two ways of economizing, looked at from the fuel standpoint," added Dr. Garfield: "One is to build your plant, or where, as in some instances, it is already built, to enlarge your plant at the point of production, namely, at the mine or at a point remote from the mines but in the center of a manufacturing district. In a place like eastern Ohio, or in the Pennsylvania fields, the central plants can be most economically set up in the midst of the coal-mining region, so that there is the shortest haul on coal, because the manufacturing district lies right around near at hand and can be economically reached by the energy. On the other hand, where no coal is produced the coal should be brought to a central point—central that is to the manufacturing interests—and a plant there established or enlarged, as the case may be, to furnish the energy. The location of such a plant would be of importance. It should be so located that it could receive its coal by transportation through the less congested districts; perhaps by barge would be the best way out of the New York ports, so as to avoid the open sea haul."

NECESSITY OF FINANCIAL AID FROM GOVERNMENT

Chairman Sims, summarizing the points as emphasized by Dr. Garfield, said that, as he understood, it would be very difficult to finance the construction of the large central stations without government help. The cost of construction at this time would be so great that there would have to be a loss to the owner of the plant after the war.

Dr. Garfield said that the whole question of amortization cannot be carried on successfully except under some government regulation.

Chairman Sims—And government assistance in building the plant? Dr. Garfield—Yes.

Representative Esch asked questions bearing on the use of culm-bank coal by electric central stations in the anthracite region.

Dr. Garfield said that he had the notion some months ago that there ought to be a different price for the culm-bank coal. Engineers of the Fuel Administration and accountants at the Federal Trade Commission advised him that it would be unwise to try to make a different price, because the cost of providing for the special process of washing and the extra incidental expense would really absorb the difference due to the fact that the coal could be got out of the culm banks at less expense than the cost of mining fresh coal.

Advantages of Large Central Plants

Representative Esch asked whether a central plant would give more continuous service to many different consumers than individual plants.

Dr. Garfield—That is one of the chief arguments for putting in the central plant, yes, from the standpoint of the operators.

Representative Esch—Is that due to the fact that the individual plants are usually small and have no duplicate equipment of boilers or generators?

Dr. Garfield—Yes.

Representative Esch—While your central heating plant would be built with a view to meeting contingencies and thus always have a surplus of units?

Dr. Garfield—Yes. The difficulty just now is that they have been reduced to the place of the isolated plant because of the heavy load put on them due to the war, and that they have used up even their reserves, so they have got to build more; but your principle is right.

Representative Esch asked whether it would be possible to equalize the load of a central plant in a war industry by extending the period of use through the twenty-four-hour period.

Dr. Garfield—Yes, but not without difficulty, because of the prejudice of the miner in favor of working certain rather established hours; but by working two shifts of eight hours each there could be a distribution of the load.

Representative Stephens—Doctor, does your plan or this bill contemplate taking or uniting the existing plants in an industrial center? For example, suppose in a certain industrial center there would be fifty or sixty plants now in operation. Some of those plants use all the power they have; others do not, and perhaps many only use their maximum capacity a few hours a day. Now is it contemplated that the power produced by all of these isolated plants will run into one line and furnish a reservoir of power that can be distributed where it is needed, and thereby use the maximum power of the district instead of as at the present moment only using a portion of it in certain plants and leaving others overloaded?

Dr. Garfield—I should like Mr. Stuart [Charles E. Stuart, chief of the power and light section, Bureau of Conservation, United States Fuel Administration—EDS.] at the proper time to answer that. I have heard that discussed as one of the ways. It lies in my mind that the engineers answer that differently in different places, depending upon conditions.

Representative Stephens asked if it was anticipated that the central plants could be constructed and put into operation in time to serve a real purpose before the war closes if it should close in another year.

Dr. Garfield—I should suppose that in a good many instances certainly plants could be enlarged. Whether new plants could be put into operation to accomplish the result before the close of the war, again I should like Mr. Stuart to state to you.

Representative Stephens—Well, even though they wouldn't be installed in that reasonable length of time, the use of it during the war wouldn't end in a year. These plants will still serve a great economic purpose, I should judge, without any regard to the war?

Dr. Garfield—Oh, yes, without any regard to the war.

Representative Montague expressed it as his understanding that Dr. Garfield thought that fundamentally it is cheaper to transport power than to transport coal out of which power is to be generated.

Dr. Garfield said he thought it was, within a limited region.

Representative Montague—Your statement is that that centralization can be accomplished by two methods—coördinating certain existing plants or establishing a government plant.

Dr. Garfield—It might either be built and directed by the government as a whole or it might be better to arrange for its direction.

Representative Montague—And the government would loan the money?

Dr. Garfield—Yes. The bill is left open as I understand it in that regard.

Representative Montague asked if Dr. Garfield was viewing this from the standpoint of a permanent economic policy, as related to government intervention and government supervision or operation, or as a policy to subserve the uses of this war.

Dr. Garfield in his reply said: "It is a permanent economic policy outside of that question, whether the government runs it or not. For a long time I have been convinced that there should be that kind of economy. In 1901 and 1902, when I was actively interested in the projection of a coal enterprise in southeastern Ohio, it was a thought with me then that we ought to consider the advisability of enlarging our enterprise and putting a plant in at the mine and using our own coal that way and selling power rather than coal, because I believe in the economic principle of it."

Representative Montague said that the point of view with himself and maybe some others of the committee had been that if this is to be a permanent business in which the government enters, then time is not the essence of its merits or necessities, but if it is to be for a military purpose alone, then the question of how long the government should engage in this policy after the war is over would be a question perhaps to be determined by legislation.

War Necessity or Permanent Policy?

Dr. Garfield—I may say that I have viewed this wholly outside of the question of war necessity. My thought is, what are the merits of it as a permanent economic policy?

Representative Montague—I don't mean as a permanent economic policy, if it is a wise thing, but the question with me is, has the government the right, the con-

stitutional right, to engage in these private businesses and conduct them after this war is over as a peace policy?

Dr. Garfield—I shouldn't undertake to answer that without more careful attention to the question. I have brushed aside everything else and have said to myself, "That piece of proposed legislation appeals to me, because I believe it will accomplish what we are after." Of course, if the war comes to an end quickly, the plants may not yet be in operation, but I have proceeded on the assumption that we must get ready as if the war were to be long-continued.

Representative Hamilton—You are saying this now as a purely war emergency proposition?

Dr. Garfield—Yes.

Representative Hamilton asked just how the law would be applied in the briefest possible time.

Dr. Garfield explained what was done in the case of one central station furnishing say 90 or 95 per cent of the mines in its territory. That company sent to see if Dr. Garfield could help it to secure additional machinery which it must have. Part of the difficulty was financial. Part of it was lack of authority to get construction of the machinery hastened and the equipment delivered. Dr. Garfield had Mr. Stuart and his associates figure on the matter and turned it over to the counsel for the Fuel Administration and a contract was worked out. What they were going to do if it had seemed wise to do so was to use a fund, either what is included in the Lever act or else ask the President for the money, but it would in any event have been the government's money, $1,000,000 to be turned over to the plant for the purchase of this new machinery.

Mr. Hamilton—How would that be secured?

Dr. Garfield—That would be secured by the government having a lien on the machinery, virtually owning it until such time as the government would be settled with. In addition to that, we insisted that they must make some further provision in the way of securing it. My own notion was in the beginning that the bondholders should all consent to allow this lien of the government to be on lines very much like receiver's certificates.

Mr. Hamilton—Otherwise the government might have security on what might ultimately, or rather soon, become junk, if it was simply machinery?

Dr. Garfield—I thought that was likely to be the way. The practical difficulty was so great that the managers said they did not wish to do it, and eventually they solved it in another way, because they were able to arrange with the War Department for energy that gave the government a direct use that took the place, you might say, of a further lien.

There was then some further discussion following questions by Representative Hamilton to reveal what relief would be obtained during the war. Dr. Garfield made this statement:

"The less essential industries, being told that they could not have coal, at the outset gave up coal or some of them did. They gave up coal and went over to power where they could, which was an indirect use of coal; and without some arrangement by which we can also control power companies we were in danger of having our coal used indirectly, and not being able to curtail where we ought to curtail. The regulations which would be set up governing power companies, the government having control of them, would, of course, prevent any switching by less essential industries to power and thereby using not so much, but still, coal."

Dr. Garfield, replying to a question, said that with central-station energy coal could be mined at less expense and much greater speed.

Buy for Your Country's Sake

AUTHORITY GIVEN FOR ST. LAWRENCE RIVER DAM

New Construction Plan to Increase Output of Electricity at Massena, N. Y. Is Approved Despite Objections

Authority will be given to the St. Lawrence River Power Company to construct a submerged weir in the South Sault Channel of the St. Lawrence River near the entrance of the company's power canal leading to the power house at Massena, N. Y. This decision follows a meeting of the International Joint Commission at Montreal, at which the application of the company for authority to undertake this construction was strongly opposed by the Canadian government.

At the meeting of the commission the Dominion government insisted that building the weir would interfere with navigation in the channel, in contravention of the provision of the Webster-Ashburton treaty; also that it was against public interest to permit such work to be done by private corporations, inasmuch as the control of the water level of the river would pass from international territory to the power house at Massena.

It was pointed out by the United States War Department that the erection of the weir was necessary to increase the output of aluminum for war purposes, and A. B. Davis, president of the Aluminum Company of America, said that increased production of aluminum could not be secured at any other point. He wanted the dam for war purposes during the war and to prevent interference by ice with the ordinary production after the war. The State of New York maintained that title to any structures in the St. Lawrence River should remain in the State of New York, and that while there would be no objections to grant permits for the duration of the war, the state was opposed to a permanent hindrance to navigation of the South Sault Channel.

It was intimated by the Dominion government that if the commission granted the application, the Canadian government would at once request the United States government to guarantee that the weir will be removed upon request at any time after the war. Formal protest would also be made against the present diversion of water through the St. Lawrence River Power Company's power canal and against any possible future increased diversion.

Those representing interests in this country were Marshall McLean of the State of New York, Judge Koonce of the United States War Department, George Gordon, Pittsburgh, and Leighton McCarthy, Toronto, attorneys for the power company; Henry Holgate, Montreal, B. F. Groat, Pittsburgh, and James W. Rickey, engineers for the power company.

PRIORITY REGULATIONS FOR THE JOBBERS AND DEALERS

Text of the Circular Outlining Priority Position of Manufacturers and Distributers in the War Industries Board Program

Following is the complete text of Circular No. 23 of the Priorities Division of the War Industries Board, addressed to all electrical manufacturers and resale distributers of electrical equipment, apparatus, appliances and supplies and signed by Edwin B. Parker, Priorities Commissioner, under date of Sept. 17:

I. It is in the public interest that all jobbers, wholesalers and resale distributers of and dealers in electrical equipment, apparatus, appliances and supplies should be permitted to maintain reasonable stocks from which government agencies, war industries, contractors and the civilian population may draw to meet essential requirements. Such persons, however, should recognize the existing necessity for rigid economy in the use of all such products and their duty to see that such products shall be devoted to essential uses, and they should pledge their whole-hearted coöperation in a program to accomplish such results.

II. Jobbers, warehousers and resale distributers (all of whom will be herein referred to as jobbers) through their war service committee have already obligated themselves to assist in securing such results. They will be permitted to maintain reasonable stocks and distribute therefrom as follows:

1. Each such jobber will execute and file its pledge of coöperation addressed to the Priorities Division (mailing same to the electrical and power equipment section of the War Industries Board). Such pledge of coöperation will be as follows:

PLEDGE OF JOBBERS, WAREHOUSERS AND RESALE DISTRIBUTERS OF ELECTRICAL EQUIPMENT, APPARATUS, APPLIANCES AND SUPPLIES

Priorities Division, War Industries Board,
Washington, D. C.

The undersigned hereby pledges itself:

(1) Not to use, nor so far as lies within its power permit to be used, any electrical equipment, apparatus, appliances or supplies which now are or may hereafter come into its possession or under its control except for essential uses as that term has been or may be defined or applied from time to time by the Priorities Division of the War Industries Board.

(2) Not to make any sales or deliveries from its stocks except (a) such small sales from shelf stocks as are necessary to meet minor needs of the community which it serves; (b) such sales as are warranted by priority certificates or by automatic priority ratings issued or authorized by the Priorities Division; (c) sales of appliances the manufacture of which has been approved by circular or express permit of the Priorities Division and for whose sale a pledge has been given by such jobber to the manufacturer thereof, or (d) sales to dealers, contractors, retailers, repairmen or others buying for resale who have filed with the undersigned a pledge in writing similar to this pledge.

(3) That, in ordering electrical equipment or apparatus, it will furnish the manufacturer in the manner prescribed by such manufacturer information regarding stocks of substantially similar ratings and types then on hand and the essential character of the sale or sales made justifying the order placed.

(4) That it will use its utmost endeavor to reduce all stocks to the minimum consistent with the essential requirements of the territory to be served, to prevent hoarding of stocks and to insure that they be distributed solely for essential purposes.

When the Priorities Division shall have approved such pledge, the electrical and power equipment section will issue to such jobber its certificate declaring such jobber to be entitled to avail itself of the benefits of this circular.

2. To the extent that its sales fall within the limits of the foregoing pledge, a certificated jobber shall be entitled to place with any manufacturers or jobbers constituting its sources of supply orders for stock, provided:

(a) That such orders for stock shall not be in substantial excess of the amounts actually sold from previous stocks.

(b) That due regard has been had for such jobber's obligation to reduce all stocks to the minimum consistent with the essential requirements of the territory which it serves.

(c) That each order for electrical equipment or apparatus is accompanied by a statement as indicated in item 3 of its pledge. The electrical and power equipment section will revoke its certificate issued to any jobber for any violation of the pledge given by such jobber and will certify such revocation to such jobber's suppliers, and the Priorities Division will withhold from such offender all priority assistance.

3. All orders for stock placed in accordance with the foregoing plan shall be and they are hereby rated as Class B-4 and entitled to priority and precedence accordingly, conditioned that any certificate holder, when placing any order with any supplier, must have on file with such supplier a copy of the certificate issued to holder by the electrical and power equipment section.

III. All dealers, contractors, retailers, repairmen and others buying for resale (all of whom will be herein referred to as dealers) not holding certificates issued by the electrical and power equipment section (except jobbers whose certificates have been revoked) will pledge their coöperation and will be permitted to purchase reasonable quantities of electrical goods for resale and to distribute same pursuant to the following plan:

1. Each such dealer will execute and file with each of its suppliers its pledge of coöperation. Such pledge will be signed by the person, firm or corporation owning such business or by an authorized executive thereof and will be in the following form:

PLEDGE OF ALL DEALERS, CONTRACTORS, RETAILERS, REPAIRMEN AND OTHERS BUYING ELECTRICAL GOODS FOR RESALE

To.....
City of.....
State of.....

The undersigned hereby pledges itself:

(1) Not to use, nor so far as lies within its power permit to be used, any electrical equipment, apparatus, appliances or supplies which are now or may hereafter come into its possession or control except for essential uses as that term has been or may be defined or applied from time to time by the Priorities Division of the War Industries Board.

(2) That, in ordering electrical equipment or apparatus, it will furnish its source of supply, in the manner prescribed by such supplier, information regarding stocks of substantially similar ratings and types and the essential character of the sale or sales made or to be made justifying the order placed.

(3) That it will use its utmost endeavor to reduce all stocks to the minimum consistent with the essential require-

ments of the trade served, to prevent hoarding of stocks and to insure that they be distributed solely for essential purposes.

2. All orders placed in accordance with this pledge shall be and they are hereby rated as Class C and entitled to priority and precedence accordingly, conditioned, however, that such dealer shall have on hand with its supplier its said pledge.

3. Any supplier of any dealer with whom any order is placed by such dealer in accordance with the plan prescribed by this circular shall scrutinize such order carefully in the light of the then relationship of supply and demand generally of the particular electrical goods and the needs of the trade served by the dealer placing such order.

4. Any violation by any dealer of its said pledge must be promptly reported to the electrical and power equipment section, and such section will certify such dealer to its suppliers to be no longer entitled to avail itself of the benefits of its priority classification under this circular, and the Priorities Division will withhold from such offender all priority assistance.

IV. The War Industries Board will rely upon such certificated jobbers and their war service committee and trade supplied by them to see that the policies mentioned herein are safeguarded as to all business done through such jobbers or which comes under their observation. It will rely upon the manufacturers of electrical goods and trade supplied by them to see that the policies mentioned herein are safeguarded as to all business done by such manufacturers or which comes under their observation.

The government is depending upon the experience and patriotism of all manufacturers, jobbers, dealers and consumers to assist it in securing an equitable distribution of all products and their application solely to essential uses.

Make the World Safe—Buy Bonds

WORK ON STANDARDIZATION FOR THE HOUSING PROJECTS

Manufacturers Form Committee on Electrical Materials Advisory to the Building Materials Section of the War Industries Board

Rapid progress has been made in the organization of the movement to assure standardization of the electrical materials required for the extensive housing projects planned by the government.

As stated in last week's issue of the ELECTRICAL WORLD, a conference was held on Sept. 13 in Washington between Richard L. Humphrey, chief of the building materials section of the War Industries Board, and representatives of the manufacturers producing the kinds of supplies needed for the government program. The manufacturers met again on Sept. 17 at the headquarters of the Associated Manufacturers of Electrical Supplies, New York.

The manufacturers have formed the "committee on electrical materials advisory to the building materials section of the War Industries Board" with the following members:

J. C. Dallam, chairman, representing seventy-seven manufacturers of wiring devices.

W. H. Thornley, representing nine manufacturers of nonmetallic flexible conduit.

F. W. Hall, representing ten manufacturers of metallic flexible conduit and armored conductor.

D. H. Murphy, representing eleven manufacturers of rigid conduit.

C. E. Corrigan, representing two manufacturers of metal molding.

H. D. Betts, representing twelve manufacturers of outlet boxes.

H. R. Holmes, representing forty manufacturers of electrical porcelain.

H. W. Bliven, representing twenty-one manufacturers of metal reflectors.

Mr. Dallam, as chairman, has advised Mr. Humphrey that other groups of the manufacturing industry are organized and that members can be called promptly to act on this committee if developments show the need of greater range of representation than now included.

Each branch of the industry represented has already well under way a very complete program of conservation, the reports of which will be made to the Conservation Division of the War Industries Board within a week. The work with the building materials section will follow along the line of recommending the standards included in this program.

Use Your Money Wisely—Buy Bonds

TENTATIVE PROGRAM FOR ILLUMINATING ENGINEERS

Outline of the Proceedings Scheduled for the Illuminating Engineering Society Convention in New York on Oct. 10

Following is the tentative program for the annual convention of the Illuminating Engineering Society, to be held in the Engineering Societies Building, New York, on Oct. 10:

Morning Session—9:30 A.M.

Presidential address, G. H. Stickney.

Report of committee on progress, F. E. Cady.

Report of committee on nomenclature and standards, A. E. Kennelly.

Statement on behalf of United States national committee of International Commission on Illumination, E. P. Hyde.

New York State automobile headlight law, F. M. Hugo.

Report of committee on automobile headlighting specifications, C. H. Sharp.

Report of committee on lighting legislation and statement concerning work of divisional lighting committee, L. B. Marks.

Statement concerning war committee of technical societies, D. W. Brunton.

Report of committee on war service, P. S. Millar.

Four-minute Liberty loan talk.

Afternoon Session—2:00 P.M.

"Lighting of Cantonments," Bassett Jones.

"War-Time Lighting Economies," committee on war service.

"Light as a Manufacturing Stimulant," W. A. Durgin.

"Protective Lighting," Edmund Leigh.

"Influence of Lighting Curtailment Upon Accident Hazards," R. E. Simpson.

"Plan for Insuring Quality of Industrial Reflectors," Ward Harrison.

In the evening at a dinner-meeting speakers of national note will discuss the war and illumination.

It Is Liberty for You—Buy Bonds

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

International Association of Municipal Electricians.—As previously announced in the ELECTRICAL WORLD, the annual meeting of the International Association of Municipal Electricians will be held in Atlanta, Ga., Sept. 24 to 27, inclusive.

Kansas Public Service Association.—It has been announced that the meeting date of the Kansas Public Service Association has been changed. The meeting, which is to be an informal conference, will be held at Hutchinson, Kan., on Oct. 4.

A. I. E. E., Cleveland Section.—A joint meeting of the Cleveland Section of the American Institute of Electrical Engineers and the Society of Automobile Engineers was held Sept. 19. C. F. Kettering, president of the Society of Automobile Engineers, addressed the meeting. The regular meetings of the Institute will begin in October, it has been announced.

Engineers' Society of Milwaukee.—The regular monthly meeting of the Engineers' Society of Milwaukee was held under the auspices of the Milwaukee Section of the American Institute of Electrical Engineers on Sept. 11, 1918. E. R. Shephard, associate electrical engineer of the United States Bureau of Standards, Washington, D. C., gave an illustrated talk on "The Work of the Bureau of Standards with Special Reference to Local Electrolysis Surveys."

N. E. L. A., Michigan Section.—W. M. Lewis, vice-president, and H. Silvester, secretary, of the Michigan Section, National Electric Light Association, have announced that the convention of the section, which was to have been held Sept. 17 and 18 at the Hotel Pantlind, Grand Rapids, Mich., has been postponed indefinitely. Developments have shown that it is inconvenient for many members to attend, and the prospect of a small attendance was the immediate cause of the postponement.

A. I. E. E., Pittsburgh Section.—The first meeting since summer adjournment of the Pittsburgh Section of the American Institute of Electrical Engineers was held Sept. 17. "Fundmental Principles and Application of Electric Arc-Welding Apparatus" was the subject of discussion by A. M. Gandy, general engineer of the Westinghouse Electric & Manufacturing Company. The paper was illustrated with lantern slides and embodied the advances made in arc welding in the last year.

Massachusetts State Association of Electrical Contractors and Dealers.—A short business meeting of this association will be held at the Hotel Kimball, Springfield, Mass., at 10 a. m. Saturday, Sept. 28. The contractors have been invited by the New England Section of the National Electric Light Association to attend the Saturday afternoon meeting, at which a paper will be read by John J. Gibson of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The meeting, which is one of the sessions of the annual convention of the latter association, will also be addressed by William L. Goodman.

American Society of Mechanical Engineers.—Marcel Knecht, member of the French High Commission in the United States, addressed a meeting of the American Society of Mechanical Engineers on Sept. 17 at the Engineering Societies Building, New York City. The subject of the address was "The Supreme Effort of the French War Industries—Franco-American Industrial Coöperation During and After the War." Brigadier-General L. B. Kenyon of the British War Mission, recently returned from a trip to the front, told of his experiences, including his observations of salvaging work and machine and repair shops. He discussed particularly the necessity, even yet not thoroughly appreciated, for precision work in manufacturing ordnance.

A. E. R. A., Manila Section.—At a meeting of the Manila Joint Company Section No. 5 held recently Miguel E. Borja, watch engineer of the power-plant department of the Manila Electric Light & Railroad Corporation, read a paper on the "Economical Production and Transmission of Electric Power." He enumerated the various pieces of power-plant apparatus essential for the conversion of the heat energy contained in coal into electrical energy and laid stress on the necessity of keeping all apparatus clean and in good repair. In this connection he pointed out that the improper maintenance and operation of steam boilers results in from 6 to 20 per cent decrease in efficiency and that the condition of the condensers as to cleanliness and vacuum has much to do with the overall efficiency of the steam turbine to which the condenser is connected. In the company's Morales power plant improved methods of operation in the boiler room have increased boiler efficiency by 10 per cent. Relative to the efficiency of transmission lines, Mr. Borja stated that while the power plant is much handicapped by machinery of which the operation and efficiency are largely beyond the control of the transmission line, the only limit to its efficiency is that of adjusted capital. The average loss on the lines of the company is about 15 per cent, although an additional 10 per cent is unaccounted for. This unaccounted-for loss is now being studied in order to eliminate it.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Rate of Return.—In discussing rate of return in a case affecting the Lockport Light, Heat & Power Company, the New York Public Service Commission, Second District, says in part: "We know that at the present time it is difficult, if not impossible, for such a company to sell its securities at any price, and the fact that the company might be able to pay its stockholders a return of 8 per cent on their investment would not make any substantial demand for them. Beyond this it is not known how long the present situation is to prevail. People who are versed in financial matters believe that rates for money will be high for several years after the present unusual conditions have become a thing of the past and the world has been restored to normal conditions. We believe that those who invest in the service of the public in a city the size of Lockport should receive a return of 8 per cent."

Amortization of Steam Plant When Stations Are Connected.—In upholding an advance in rates by the Southern Illinois Light & Power Company, the Illinois Public Utilities Commission says regarding a charge of $696 for amortization of the cost of the Coulterville steam plant: "The amount included by the petitioner for the amortization of the Coulterville steam plant is included upon the theory that the construction of the transmission line connecting these two communities enabled a saving to be effected, and that, in order to care properly for the company's investment, this investment should be amortized over a period of years. If sufficient showing were made as to the savings which will actually be effected by a combination of systems in this manner, the arguments advanced by the petitioner would be entitled to very serious consideration. Frequently the construction of transmission lines and the linking together of various generating stations is to be desired, since in many cases it insures a better grade of service than would be financially possible from small isolated stations and in many cases offers opportunity for a more economical generation and distribution of energy. However, the allowance of an amount such as here proposed in operating expenses must certainly be predicated upon a showing as to the saving which is really effected by such a method of operation, and such a showing is not made in the record herein, and under the circumstances scarcely could be made until some time had elapsed under the new scheme of operation."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Town Dark Because of Poor Coal.—In the municipal plant at Hamilton, Ohio, it was found impossible recently to get sufficient steam to operate the generators, and as a consequence street lamps were dark one entire night. Only sufficient energy could be generated to supply domestic patrons.

Women in Industry.—Dr. Francis D. Patterson, chief of the division of industrial hygiene and engineering, Department of Labor and Industry of Pennsylvania, Harrisburg, has sent questionnaires to 1500 industrial physicians asking for data. The questions deal with the employment of women in industry due to the war emergency. They cover the matters of physical examination, whether the pay is equal to that of men, hours of employment, uniform, wearing of jewelry, etc.

Further Sign Curtailment Likely in San Francisco.—Restrictions on street signs in San Francisco, which expire Sept. 30, may have to be extended to prohibit their use seven days a week instead of five, according to a recent announcement made by State Power Administrator Butler. The power situation has not improved, according to Mr. Butler, but on the contrary is reaching a more critical stage, and it will probably be necessary to extend rather than modify present restrictions on the use of power.

Bessemer Ferro-Silicon Made Electrically.—Chattanooga has added to its industrial activities the Chattanooga Electro-Metals Company. Although encouraged by the government, it is purely local, being Chattanooga-made to a great extent and financed with Chattanooga capital. It adjoins its sister plant, the Southern Ferro-Alloys Company, of which Mr. Kruesi is also president. The capital stock of the company is given at $200,000, and the personnel is as follows: Paul J. Kruesi, president and treasurer; N. Thayer Montague, first vice-president and secretary; G. L. Davison, second vice-president and manager; Arthur Raymo, general superintendent; D. H. Cowan, assistant superintendent; R. L. Patterson, chemist; H. H. Rushbridge, chief electrician; N. W. Westbrook, assistant secretary. The plant is already in operation. The three transformers have a total rating of 4000 hp. and weigh 21,000 lb. apiece as shipped. Chattanooga's original electric furnace plant, that of the Southern Ferro-Alloys Company, is by far the largest customer of the Chattanooga Railway & Light Company. The new plant is the second largest user of power in or around Chattanooga. Energy will be supplied at 6600 volts, the alloy plants doing their own transforming. The design of the plant was intrusted to the Fitzgerald Laboratories, Niagara Falls, N. Y. The product will be sold by the Fairbanks Morse interests, New York City.

Standardization of Telephone and Telegraph Rates.—Postmaster-General Burleson will order standardization of telephone and telegraph rate schedules throughout the country. David J. Lewis, member of the Postmaster-General's committee directing the government control of wires, will be in charge of both investigations. On the telegraph rate committee with him will be John C. Willever, vice-president of the Western Union Telegraph Company, and Edward Reynolds, general manager of the Postal Telegraph Company. H. B. Thayer, vice-president of the American Telephone & Telegraph Company, and Charles Y. McVey, president of the Ohio Telephone Company, are the committee for the telephone inquiry.

Fuel Administrator Expected to Limit Power Use in California.—Further restrictions in the use of power by industries in California not wholly engaged in the manufacture of war materials will probably be ordered soon, according to recent announcement made by Fuel Administrator Schwabacher. In order to determine the amount of power necessary for the lesser industries, all power companies are to forward to the Fuel Administrator the names and addresses of their customers, together with class of work performed, amount of power consumed by each and the percentages of war materials made. From these data a preferential list will be compiled, and a supply of power will be assured to those industries wholly engaged in war work. Lightless nights will be enforced throughout the state on Monday and Tuesday only, beginning Oct. 1

Securities Must Await Liberty Loan.—The Capital Issues Committee has passed a resolution providing that in view of the paramount importance of meeting the government's financial requirements for war purposes the committee will not pass any application respecting sale or offer for sale of shares or securities during the period from Sept. 15, 1918, until after the close of the fourth Liberty loan campaign, except applications which the committee may regard as urgently necessary. Investment houses, brokers, corporations and others offering the unsold portion of security issues heretofore passed by the Capital Issues Committee are asked to withdraw the same from public offering or solicitation during the period from Oct. 1 to the close of the Liberty loan campaign in order to give the government the right of way. This action is not intended to restrict counter sales or sales of listed securities made in the ordinary course of business on stock exchanges.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Power of Commission.—The Public Service Commission act, being highly remedial, must be liberally construed, the Supreme Court of Missouri held (204 S. W. 497). The ascertainment and establishment of reasonable rates for public service is within the police power of the state. The fixing of reasonable rates for public service may be delegated by the Legislature to the Public Service Commission, subject to court review of the question of reasonableness.

Liability for Injuries Caused by Plant Guard.—Where soldiers, not under the control of defendant, were placed on guard around his power plant in the interest of the general public by the United States military authorities during a warlike situation, to suppress a hostile invasion, which was imminent, and not at defendant's request, defendant was not liable to an employee shot through the negligence of a soldier, although if he were the employer of the soldier he would be liable, the Court of Civil Appeals of Texas held in Sweetman versus Laredo Electric & Railway Company (204 S. W. 701). In action against employer for injuries caused by a soldier guarding defendant's plant, where it clearly appeared that the soldier was not an employee, testimony relevant only to the question of whether the soldier was negligent, if improperly admitted, was not a reversible error.

Power to Fix Price.—The question whether the Public Service Commission has been endowed by statute with the power to adjudge unconstitutional a confiscatory statute fixing a maximum price for gas is not between the gas company and the state, but between the commission and the state, it was held by the Court of Appeals of New York (120 N. E. 132). The Legislature legally could empower the Public Service Commission to fix by order in any given case the maximum price to be charged for gas, not exceeding that fixed by statute. As between the Public Service Commission and the Legislature from which it derives its powers, the commission being empowered to fix a price for gas not in excess of the statutory maximum, it is immaterial that the legislative maximum price is confiscatory, even manifestly confiscatory, of a gas company's property. In view of the laws of 1907 fixing $1 per 1000 cu.ft. as the maximum price of gas in Albany, under the Public Service Commissions law the commission has not power to authorize gas company to charge in Albany a greater price, even if legal price is confiscatory.

J. P. Powell of Valdosta, Ga., has become manager of the Selma (Ala.) Lighting Company.

Lieut. C. E. Norenberg, formerly of the engineering department of H. M. Byllesby & Company, Chicago, has been commissioned captain.

George Williams, manager of new business of the H. L. Doherty Organization, has been elected a director and vice-president of the Crew Levick Company.

Victor V. Starzenski, assistant general manager of the Schenectady (N. Y.) Illuminating Company, has been commissioned first lieutenant in the chemical warfare service of the army. He left recently for the Edgewood Arsenal, Baltimore. His work there will deal mostly with the manufacture of gases for use in France.

Leonard W. Egan, formerly special engineer with the Wellman-Seaver-Morgan Company, has severed his connection with that concern and has become associated with the Electric Furnace Company, Alliance, Ohio, in a similar capacity. Previous to Mr. Egan's connection with the Wellman-Seaver-Morgan Company, he was for five years electrical engineer of the Pittsburgh Crucible Steel Company, Midland, Pa.

W. B. Miser, manager of the Drumright division of the Oklahoma Gas & Electric Company, has received a commission as captain in the Engineer Corps of the United States Army and will leave shortly for one of the cantonments. Early this year he was appointed chairman for Drumright of the Military Training Camp Association. He went to Drumright about a year ago, having formerly been general superintendent for the Illinois Traction System at Jacksonville, Ill.

Frederick A. De Lay, who has been instructor in the Chicago Central Station Institute of the Commonwealth Edison Company, has resigned to accept a position as assistant superintendent of the Mechanical Appliance Company of Milwaukee. Mr. De Lay has been in the employ of the Insull interests of Chicago six years, having been connected at one time with the engineering department of the Public Service Company of Northern Illinois. He was recently elected as secretary of the Chicago Section of the Illuminating Engineering Society.

Charles B. Youts, who has been connected with the Illinois Northern Utilities Company since 1912, has resigned to become manager of the La Crosse (Wis.) properties of the Wisconsin-Minnesota Light & Power Company. Mr. Youts started with the Illinois Traction System in 1906 as sales manager at Danville, Ind. In 1910 he became new-business manager for the entire system. Two years later he resigned to become general contract agent with the Illinois Northern Utilities Company, Dixon, Ill., which position he has held since then.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

G. E. Chapman, who for the last year has been superintendent of Division L of the Public Service Company of Northern Illinois, with headquarters at Lacon, has resigned.

Peter S. Klees, sales manager of the Franklin Electric Manufacturing Company, Hartford, Conn., has just been made vice-president of the company also. Mr. Klees was born in Lebanon, Pa., in January, 1879, and received his early education locally. He entered the electrical industry in the employment of the American Electric Lamp Company of Philadelphia, where

P. S. KLEES

he remained until about twelve years ago, when he became connected with the Franklin company as sales manager. He is a very active member of a number of important committees in the lamp industry, besides being a member of several national electric associations. During 1916-17 he was Jovian congressman for New England.

Prof. James Theron Rood has resigned as professor of electrical engineering of Lafayette College, Easton, Pa., to take up the professorship of railway electrical engineering in the department of transportation at the University of Illinois, Urbana, Ill. Professor Rood was graduated from the Worcester (Mass.) Polytechnic Institute in 1898 with the degree of B. S. and received the degree of Ph. D. from Clark University in 1906. He was instructor in physics and mathematics at Ursinus College, 1906-07; instructor in physics and electrical engineering at the University of Alabama, 1907-09, and since 1909 professor of electrical engineering at Lafayette College.

J. A. Schabeck, formerly assistant superintendent of Division O of the Public Service Company of Northern Illinois, has been appointed superintendent of Division L, succeeding G. E. Chapman, resigned.

Edwin Jowett, for many years assistant chief engineer of the Fish and Quarry Street stations, Commonwealth Edison Company, Chicago, and for the past four years chief operating engineer for the Texas Power & Light, the Fort Worth Power & Light and the Dallas Power & Light Companies of Texas, which position he recently resigned, has been appointed superintendent of power plants of the Kansas City Light & Power Company, Kansas City, Mo.

Richard H. Wheeler, who was recently appointed traffic manager of the Hercules Powder Company at the Nitro plant, Nitro, W. Va., is well known in electrical engineering circles. Mr. Wheeler was assistant designing engineer of the electric locomotive department of the General Electric Company in 1911-12. From 1912 to 1915 he was assistant electrical engineer on the electrification of the Mount Royal tunnel and terminal project of the Canadian Northern Railway at Montreal, in charge of designing and building of the electric locomotives, multiple-unit cars, shops, signals, etc. From 1915 to 1917 he was assistant engineer of the Shawinigan Water & Power Company at Montreal. From 1917 to 1918 he was designing engineer with Ford, Bacon & Davis, New York, and from February, 1918, up to the time of his appointment in the Hercules Powder Company, he was assistant manager of the power apparatus department for the Thompson-Starrett Company, construction engineers, building the United States government explosive plant "C."

Charles F. Wallace has withdrawn from the Stone & Webster organization to enter the service of the government in the Emergency Fleet Corporation, with headquarters at Philadelphia. Mr. Wallace was graduated from the Massachusetts Institute of Technology in 1892 and immediately entered the service of Stone & Webster, being stationed in the Boston office. He soon became chief of the engineering department and later was transferred to the Stone & Webster Management Association, where he devoted himself to public utility development and administration, including important hydroelectric projects in the West and South and the supervision of properties in the Southeast and on the Pacific Coast slope. For several years he was a vice-president of the management association, and he has lately been making his headquarters at Dallas, Tex., in the interest of the Stone & Webster properties in that section. As an engineering executive Mr. Wallace attained a high reputation during the development period of the Stone & Webster organization, and in his later administrative work he has had great success.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

RECORD FISCAL YEAR IN ELECTRICAL EXPORTS

For the Twelve Months Ended June 30 Last Electrical Merchandise to the Value of $54,527,570 Was Exported

A new record in electrical exports has just been hung up. During the fiscal year of the Department of Commerce $54,527,570 worth of electrical merchandise manufactured in the United States was exported, the largest fiscal year in history. This was less than $1,000,000 under the record calendar year of 1917.

The five preceding fiscal years stood as follows: 1913. $26,772,816 (then the record); 1914, $25,060,844; 1915, $19,771,757; 1916, $30,256,778; 1917, $51,903,823.

The accompanying table compiled from reports by the Bureau of Foreign and Domestic Commerce shows to what extent and in what direction the foreign trade has grown. Attention is called to the figures for batteries, which have jumped from $685,640 in 1914, when they were first listed, to $3,351,838 in the last fiscal year. While a considerable part of this increase, of course, is a matter of price, still the demand for batteries by the warring nations, particularly dry cells, has required a large expansion in this trade.

The value of generator exports is about the same as before the war. It is therefore evident that the volume of business in this line has fallen off. Insulated wire and cable exports have grown greatly since the war began, but there was a perceptible falling off last year. The decrease in volume, however, was probably very slight, if any, owing to the drop in price of wire and the settlement of a government price which holds for allied-country purchases.

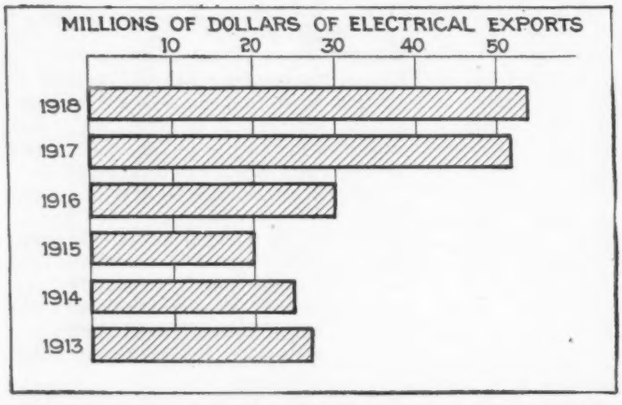
Metal-filament lamp exports have grown by leaps and bounds from $394,692, representing 1,363,493 lamps, in 1913 to $3,183,021, or 14,865,899 lamps, in the last fiscal year. Motor exports have about doubled in value in the last six years, but a large part of this of course represents increased prices. The item "all others" fell off apparently last year because certain items formerly included therein have been given a separate classification.

Figures for the month of June are also shown in the table. June last was the second largest electrical export month, December last being the largest by two or three hundred thousand dollars, around 5 per cent. Exports of batteries, insulated wire and cable and of motors were particularly large.

The illustration shows graphically the totals contained in the table.

ELECTRICAL EXPORTS OF THE UNITED STATES FOR JUNE AND FOR FISCAL YEAR 1917-1918

Articles	June		Twelve Months Ended June					
	1917	1918	1913	1914	1915	1916	1917	1918
Batteries	$442,846	$272,316	.....	$685,640	$967,146	$1,569,836	$3,009,676	$3,351,838
Carbons	.....	117,995	.....	.....	.....	.....	.....	1,525,128
Dynamos or generators	277,575	133,549	$2,773,407	2,634,385	2,013,130	1,468,961	2,554,504	2,688,169
Fans	79,580	164,486	358,781	432,656	258,309	356,729	482,652	818,338
Heating and cooking apparatus	.....	49,185	.....	.....	.....	.....	.....	533,988
Insulated wire and cables	633,235	340,138	.....	1,992,304	1,911,850	3,157,239	7,192,204	5,716,275
Interior wiring supplies, including fixtures	102,731	138,805	.....	721,069	753,351	818,985	1,123,664	1,532,309
Arc lamps	1,061	90	186,019	76,766	30,984	18,693	15,752	13,308
Carbon-filament lamps	20,949	3,985	228,288	172,064	101,923	144,872	157,413	144,761
Metal-filament lamps	357,275	475,768	394,692	219,439	473,149	1,282,039	2,143,802	3,183,021
Magnetos, spark plugs, etc	.....	167,710	.....	.....	.....	.....	.....	3,167,325
Meters and measuring instruments	84,072	208,294	.....	.....	440,916	776,381	1,039,149	1,592,195
Motors	643,862	521,442	3,797,917	4,541,541	2,819,743	4,218,974	5,889,770	6,598,664
Rheostats and controllers	.....	24,170	.....	.....	.....	.....	.....	212,059
Switches and accessories	.....	188,408	.....	.....	.....	.....	.....	2,229,023
Telegraph apparatus, including wireless	19,915	11,659	215,105	136,592	76,271	148,536	539,389	294,297
Telephones	283,152	274,809	1,371,546	1,552,951	1,149,361	1,329,346	1,953,504	2,566,929
Transformers	162,180	464,195	.....	1,455,343	624,483	993,193	1,265,459	2,235,847
All other	2,472,009	1,462,515	17,447,061	10,440,114	8,152,141	13,972,994	24,536,885	16,123,996
Total	$5,580,442	$5,019,519	$26,772,816	$25,060,844	$19,771,757	$30,256,778	$51,903,823	$54,527,570



GRAPHICAL REPRESENTATION OF COMPARATIVE ELECTRIC EXPORTS FOR FISCAL YEARS FROM 1813 TO 1918

The illustration shows graphically the totals contained in the table.

VERY LITTLE DEMAND FOR POLE ERECTION TOOLS

Ash to Manufacture Handles Is Now More Difficult to Obtain than Steel—Prices Much Higher than Formerly

To determine the market condition of pole erection equipment in so far as demand is concerned is simply to answer the question, "How much new construction work is there going on?" This equipment is seldom purchased except for new construction, and when the construction is completed the equipment is adequate for several years for maintenance purposes. The present financial status of public utilities in general, plus the urgent requests of the government, prohibit any new construction that is not absolutely essential to industry and public welfare.

This answer to the foregoing question bears out the report of manufacturers that there is little demand for such articles as pikes, cant hooks, shovels, spoons, picks, digging bars and "jimmies." Because of the small demand and poor prospects for any immediate need very little stock is being carried. A small quantity of shovels and spoons is kept on hand, but few of the other tools. Although steel is a scarce commodity, it is reported that for the manufacture of pole erection equipment wood for handles is obtainable in still smaller quantities. Steel can be manufactured, but wood has to be grown. A few years ago certain manufacturers of these tools specified and would accept only second-growth ash with straight grain. Later they were requested to and did accept other than second growth, and still later ash with the grain at a slight angle to the axis of the handle had to be accepted. This was followed by the use of maple as well as ash, and at the present time little but maple can be obtained.

In fact, the supply of wood handles for replacement purposes has been particularly short this year. Prices are higher. Hardware jobbers in certain sections report the arrival recently of a fair supply of handles, but generally there is the complaint of insufficient stocks to meet the demand.

All tools are up in price, and those used in the erection of poles are no exception, as they have come in for an advance of from 50 to 75 per cent. Only last week prices advanced 10 to 15 per cent on this line. Delivery of orders in any considerable quantity may be somewhat delayed by the existing conditions.

No curtailment of types has as yet been reported. In other construction and digging lines, however, there has been a marked reduction in the number of types of tools that are being produced.

METAL MARKET SITUATION

Little Change in Prices—Tin Still Unsettled—Very Little Trade

There was little activity in the metal market during last week. Except for a falling off in antimony and a slight rise in spelter, prices have been unchanged. Even the old-metal market was very steady.

The tin situation is still as uncertain as ever. Very little trading is taking place and no trustworthy quotations are available.

The copper market has been greatly disturbed by the I. W. W. strike at the Butte mines. Latest reports, however, indicate that the strike is broken and that the men are mostly back at work again.

Iron and steel manufacturers meet the War Industries Board this week, when permission to charge higher prices for the last quarter of the year will be sought.

NEW YORK METAL MARKET PRICES

	Sept. 10	Sept. 17
Copper:	£ s d	£ s d
London, standard spot	122 0 0	122 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26.00	Govt. price 26.00
Electrolytic	Govt. price 26.00	Govt. price 26.00
Casting	Govt. price 26.00	Govt. price 26.00
Wire base	29.25	29.25
Lead, trust price	8.05	8.05
Antimony	14.00	13.87½
Nickel, ingot	40.00	40.00
Sheet zinc, f.o.b. smelter	15.00	15.00
Spelter, spot	9.50	9.85
Tin, Chinese *	No quotations	No quotations
Aluminum, 98 to 99 per cent	Govt. price †33.10	Govt. price †33.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	23.50 to 24.50	23.50 to 24.50
Brass, heavy	14.50 to 15.00	14.50 to 15.00
Brass, light	11.50 to 12.25	11.50 to 12.25
Lead, heavy	7.50 to 7.75	7.50 to 7.75
Zinc, old scrap	6.50 to 6.75	6.50 to 6.75

* No Straits offering. † In 50-ton lots or more; carload, 33.10 cents per lb.; 1-ton to 14-ton lots, 33.20 cents per lb.

THE WEEK
IN TRADE

THE announcement by the War Industries Board of its plan for the conservation of building materials has brought such a flood of telegrams regarding buildings under way that it is now announced that all such buildings may be completed and materials may be supplied. On all new buildings, however, where the cost exceeds $2,500 and excepting government projects permits must be procured. Investigation and reports on such new projects will be made by the State Councils of National Defense under arrangements made by Bernard M. Baruch, chairman of the War Industries Board.

Total business continues as large as ever, but distributers are finding it increasingly difficult to obtain supplies of a number of staple wiring products. Prices are again advancing.

Labor conditions are still very unsatisfactory and wages are advancing. The government made it very plain in the case of the Bridgeport strike that its decisions must be carried out. The striking employees have decided to return to work. This and Dr. Garfield's action regarding the coal miners are specially significant.

It is now definitely understood that development work on electrical supplies must wait until the end of the war. Little, of course, has been done in the past three years.

NEW YORK

Government business continues to dominate the local market. Commercial inquiries are becoming fewer as the inability to get material is recognized. Supplies of essential material depend largely on the foresight of the local house in placing orders. Incoming stocks of conduit are disappointingly small. The small-wire output has been greatly reduced by the government's outpost wire needs, which utilize the small-wire machinery.

Prices have advanced on a number of lines since the first of the month, particularly those using cotton to any extent.

All construction work in the state costing $2,500 or more must be referred to the county home defense committees. In this way only necessary construction will be permitted. School buildings were ruled to be unnecessary.

WIRE.—Double braid No. 14 has been advanced slightly in price owing to the high price of cotton. The tremendous order by the government for outpost wire is taking the small-machine capacity so that it is particularly difficult to get wire of No. 8 and smaller.

TAPES.—Cotton tapes are climbing in price almost daily because of the price of cotton. In the past year the advance has been over 50 per cent.

CONDUIT.—Rigid conduit is still becoming scarcer and more difficult to get. Non-metallic is in easy supply and deliveries have been very good. Two weeks ago one manufacturer of non-metallic made an advance of 20 per cent in his product.

ARMORED CABLE.—There was an advance last week by one manufacturer on No. 14 flexible-steel armored conductor.

POLE-LINE HARDWARE.—A 10 per cent advance was made last week in this line.

CONSTRUCTION TOOLS.—Pole-line construction tool prices went up last week from 10 to 15 per cent in the entire line.

INSULATING VARNISHES.—The manufacturers of insulating varnishes and compounds are somewhat disturbed

over the failure of the War Industries Board to give their product a place on the new preference list. It is thought that these products were considered simply as varnishes. The producers, it is understood, are planning to present their case to the War Industries Board shortly.

MOTORS.—The demand for small motors has fallen away off in the local market for both new and used apparatus.

CHICAGO

The building situation has been definitely settled by the War Industries Board, and apparently the settlement was much to the liking of the electrical trade. Evidently an order of more drastic character was expected. As the situation now stands, all building under construction will be provided with material for completion. All new building projects will be reviewed by the State Council of Defense, which will report to the War Industries Board on whether or not the work is necessary. All projects reported as necessary will then receive the consideration of the non-war section of the War Industries Board, which will grant or withhold the permit and notify the State Council of Defense at once. If the State Council of Defense decides against the project, it will notify the person concerned. Through this system action on all projects should be prompt.

Building which is now contemplated in this section consists of large groups of industrial residences or factory buildings. Three hundred and fifty industrial houses are to be built at Rock Island, Ill., but there is a question as to whether the material will be bought locally or in Washington. The Wells Brothers Construction Company has been awarded a contract for the erection of 119 industrial houses at Hammond, Ind. George M. Moffett of New York has purchased 62½ acres of land from the Chicago Clearing Land Association at Archer Avenue and Sixty-third Street, Chicago, and will build fifty homes for industrial workers in this manufacturing district within a short time. Work has already been begun on a quarter-million-dollar shop building for the Panhandle division of the Pennsylvania Railroad by Charles B. Johnson & Son, contractors. These proposed jobs indicate the character of work which has come up during the week.

Announcement that Chicago's quota of the fourth Liberty loan is $250,000,000, or $100 per capita, indicates that during the coming month it will probably be necessary for a large section of the industry's man power to spend a considerable time in placing this loan.

Jobbers and manufacturers both report that orders are continuing to come in with less and less sales effort. One manufacturer voiced the belief that business is becoming more settled and that in the coming months "more business will be done with less conversation" than formerly. A few price changes which have been made indicate that the trend is still upward.

Everything that can be used for industrial building is moving out of jobbers' stocks. Wiring devices of all kinds are active. Pole-line material and other stock of this sort are slow.

WIRE.—The wire situation is becoming more difficult from day to day. The demand on smaller sizes is good.

LAMP CORD.—Word has been received that lamp cord has advanced slightly. It still remains on the 34-cent base, but the discount has been changed. Lamp cord is now sold on the same basis as copper, that is to say, it is supplied only for direct or indirect war industries.

CONDUIT.—It still remains a difficult problem to secure enough conduit to meet the industrial demand.

LAMPS.—Contrary to expectations, the announcement that the use of carbon in "gem" lamps would be discontinued has not increased the demand on jobbers' stocks. No effect has been felt. Jobbers report that they will simply refrain from ordering more stocks of these lamps, and this will automatically bring about the cessation of their use.

SCHEDULE MATERIAL.—The statement published in the ELECTRICAL WORLD of Sept. 7, page 469, to the effect that an advance in schedule material was to be expected has proved to be true. Schedule material has advanced between 7 and 8 per cent.

ELECTRIC FANS.—Best estimates place the number of fans which Chicago jobbers are carrying over at 4000. If it had been possible for the jobbers to get larger stocks early in the season, this number would no doubt be greater.

PORCELAIN.—Factories report that the labor situation is becoming more and more severe, and it is expected that the new draft laws will work a still further hardship on this business. The factories are largely working on orders which have come from the East, where interconnection is in progress, or on direct government orders.

BOSTON

Jobbers report a very active week. The tendency toward impoverishment of stocks increases, and deliveries do not show much improvement in general. Collections are fair. Prices show little sign of going lower, and the manufacturers are greatly handicapped for labor. Registration day necessarily interfered somewhat with business, but the patriotic response of the country's man power means so much to the war program in all its aspects that the effect on industry cannot but be beneficial from the standpoint of morale. New England industries are now chiefly concerned with war business and the buyer without a priority number is seriously handicapped. Contracts have been let during the past week for the construction of houses for shipyard workers at Quincy, Mass., and Bath, Me., but the market for schedule material is principally for munitions plant, factory and ship use.

CONDUIT.—Stocks are getting low and the outlook is unsatisfactory. Jobbers who have ordered carefully and with due regard to reporting the ultimate destination of their pipe seem to be in a better position than others. The "non-essential" buyer stands a poor chance of getting conduit at present at any price. Some shipments are coming through from the mills, but in general the supply is far from adequate.

FANS.—The season is practically over and a good many fans will be put away for next spring's business as summer weather was late in arriving and intermittent in duration. Some jobbers "guessed right" on the season and their stocks are nearly exhausted.

RADIATORS.—A fair business is anticipated this fall. Stocks are likely to run short, as things now look. Early deliveries are greatly needed, and the factories are almost certain to be oversold in view of the coal situation.

WASHING MACHINES.—Jobbers and dealers cannot get enough of these machines to fill orders in sight. It looks as though the jobbers would have to devote themselves to meeting the wants of their regular retail distributers, letting new business go for the present. One large Boston house is likely to be limited to a maximum allowance of twenty-five machines a month and is curtailing its sales campaigning.

STORAGE BATTERIES.—Inquiries are numerous, government orders predominating. Prices are firm and the automobile trade is still good, though dealers report a falling off in demand due to the curtailment of Sunday riding.

MOTORS.—Some orders can now be filled from stock. The volume of trade is still large, with firm prices. Deliveries are a little easier.

GENERATORS.—Deliveries are very long and prices high. Only essential orders have the right of way.

LAMPS.—Stocks of standard sizes are growing larger and the outlook is good. Miniature lamps are scarce, a large percentage of the output going into military and naval service. Prices are steady. It is reported that the supply of lamps for Ford cars is now adequate.

FIXTURES.—Stocks are large and jobbers and dealers are not buying from the manufacturers to any great extent. Though business is sub-normal, prices do not reflect it as might be expected.

FARM-LIGHTING SETS.—A price advance of $30 in the ¾-kw. sets and of $100 in the 3-kw. sets made by the Delco company is scheduled for Oct. 1. The farmers are prosperous and business is good. Government orders are also a feature of the market.

ATLANTA

Jobbers and dealers report business as being well sustained, with increases in some lines. The call for material for shipyards is growing more insistent. Miscellaneous supplies to lumber camps show a healthy growth. The demand for all classes of material for this purpose will be much greater as the year advances, owing to government activities requiring great quantities of timber. The Jonathan Starr Company, New York, is reported to have purchased 50,000 acres of timber in North and South Carolina and Georgia. Fifty mills will be established to work up approximately 1,000,000,000 ft. of heavy timber. A great portion of the output will go into railway ties.

The commandant of the Charleston (S. C.) Navy Yard proposes to build a large factory for naval clothing, also a shrinking plant and a storehouse. The type of power plant has not been decided upon as yet.

It was expected that the 150 retail power customers of the Georgia Railway & Power Company would be allowed to use service again beginning Sept. 16. The lack of sufficient rain, however, will not permit the company to supply service to its numerous hydroelectric customers.

The impression left from statements of the War Industries Board regional chairman would indicate that the government intends relaxing its embargo to some extent on building. As a result, the board has been swamped with applications. The Priority Commission rules, however, that buildings now under way may be completed. Repairs and extensions on operations where the materials purchased are less than $2,500 require no priority certificates.

STEAM-FLOW METERS.—The Fuel Administrator's activity to secure greater plant economy has stimulated the demand for flow meters, especially for feed-water measurement. Prices have advanced from 20 to 25 per cent. since Jan. 1. Shipments are very good and fairly prompt to essential industries.

SEATTLE—PORTLAND

Seattle jobbers and dealers report that sales during the past week were well sustained with no marked improvement over the previous week. The flow to shipyards and industrials continues steady, but government buying was a shade lighter. The fluctuation in prices for the past six months has been negligible, and no immediate increase is predicted by local jobbers. The freight situation is growing more serious, with no prospects of improvement, particularly during period of crop movement. Labor conditions are expected to become worse instead of showing improvement as a result of the new registration. However, it is understood that the lumber industry will not suffer as much as expected. Orders for ship timbers, railroad material and various other government and commercial requirements combined last week to set a new record for business accepted by Northwest lumbermen.

At present wire shipments are coming through fairly well, but the demand is heavy. The existing shortage in certain sizes is expected to increase. Stocks of rubber-covered and larger sizes are low. Household appliance demand is holding up well. The sale of washing machines, heavy vacuum cleaners, irons and all labor-saving devices is showing an increased demand as labor shortage becomes more pronounced. Demand for renewable fuses from shipyards and industrials is heavy. The supply is ample. Motor sales are well sustained and all kinds of power apparatus are in demand. No stocks are on hand, this equipment being delivered as ordered. Sales to shipyards are heavy.

Portland territory reports very little activity. During the past week the sales of motors were slow, and this also applies to generating equipment and larger sizes of transformers. Lamp stocks are improved materially with the arrival of heavy shipments, leaving practically no unfilled orders with the exception of miniature sizes. Jobbers report stocks on hand of practically all lines of electrical goods.

Portland jobbers have been requested by manufacturers to refrain from any sales campaign particularly in the line of electric ranges and washing machines and to sell these appliances only where actual need is shown. In other words, these appliances are not to be sold to replace any other type which is serviceable.

A number of substantial additions to present industrial plants in Portland are going on, most of them being extensions of shipyards, foundries and machine shops. Portland has guaranteed the director of transportation and housing, Emergency Fleet Corporation, that 2000 four-room and five-room cottages to be built for accommodation of shipyard workers will be well under way before the first of the year. Seattle's "more homes" campaign is daily gaining momentum, and it is believed that the original objective of 5000 homes will be easily exceeded. Other Puget Sound cities are taking similar steps to solve their own housing problem and are meeting with success.

SAN FRANCISCO

The outstanding feature of the past week has been a considerable rainfall, unexpected and unprecedented, that was eagerly welcomed by some and as earnestly deplored by others. The unfavorable effect has been the ruin of most of the grape and prune crops as well as of all other fruits that were out in trays drying at the time. Many of these firms were under contract with the government, which loaned them a thousand soldiers to assist in certain districts. The favorable effect has been the accumulation of water in depleted reservoirs and the drenching of certain districts where extensive electrical irrigation had been considered necessary, so that electricity may now be diverted to war enterprises. The federal Fuel Commissioner has warned manufacturing firms that present conservation orders must be continued and that the rain simply averted more drastic regulations.

The August building permits, with their approximate values for the three principal cities of this district, San Francisco, Oakland and Los Angeles, were respectively 324 permits with a value of $869,000, 276 valued at $901,000, and 569 of $763,000 value. New construction includes a huge shipyard to be erected by the Parr Terminal Company.

Oakland announces that it has selected a site for the settling of 4000 Mexican families that officials of the United States Shipping Board desire to bring here in connection with shipbuilding work. The United States government will construct a series of buildings to house 3500 students of the Army Training Corps at the University of California. New packing plants at Willows and Pomona and new shops for the Salt Lake Railroad terminal at Los Angeles are also announced.

STREET LIGHTING.—With five lightless nights in northern California and two such nights in southern California and such work as is now being done in Oakland for reducing the size of street lights, no further municipal action on such projects may be expected.

WASHING MACHINES.—For some time past dealers have been expecting increased sales of larger electrical appliances on account of high industrial wages, and evidences of this expectation are developing week by week. Representatives report their inability to get machines in salable sizes. The prices have so increased on account of new freight rates, raw materials and high manufacturing costs that the price on the average family machine is now $132.50 to the consumer.

MOTORS.—There are many inquiries for motors, but as each inquiry is subjected to severe scrutiny on the strength of essential requirements much business is being diverted to motor repair shops. Induction motors recently advanced 10 to 15 per cent. The recent rains that reached sterile districts will no doubt hold up many electrical irrigation projects which have been marked lately by inquiries for motors of from 25 hp. to 100 hp.

WIRE.—The municipality of San Francisco has placed a large order for trolley wire for its industrial municipal railway extension at 33⅜ cents per pound delivered.

PORCELAIN INSULATORS.—The expected demand for insulators, tubes and cleats of standard house-wiring sizes has not materialized. Authorities predicted that scarcity of conduit would re-establish these items. Porcelain strain insulators have recently decreased in price 10 per cent.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List Per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	12½%—57.25
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	12½%—66.75

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	12½%—97.75
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	12½%—126.80

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+20% to List
Coil to 1000 ft	5% to 15%
	No. 12 Solid
Less than coil	+20% to List
Coil to 1000 ft	5% to 15%

Twin-Conductor

	No. 14 Solid
Less than coil	+5% to $80.00
Coil to 1000 ft	5% to 75.00
	No. 12 Solid
Less than coil	+20% to +5%
Coil to 1000 ft	5%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	12%
1/5 to std. pkg	20%
Std. pkg	44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20% to 12%
1/5 to std. pkg	List to 20%
Std. pkg	25% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35—.36	.35—.36
50 to barrel	.31—.32	.32—.33
Barrel lots	.28—.289	.29—.299

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.319 to .322	.329 to .33
Barrel lots	.289 to .292	.299 to .302

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
⅜	250	$5.00
½	250	7.50
⅝	100	10.00
¾	50	13.00
1	50	21.00
1¼	50	26.00
1½	25–50	35.00
2	25–50	45.00
2½	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
½-in. single strip	$75.00	$63.75— 69.75
½-in. double strip	75.00— 82.50	72.00— 75.00
¾-in. single strip	100.00	85.00— 93.00
¾-in. double strip	100.00—110.00	96.00—100.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
½-in. single strip	$75.00	$63.75 to $64.25
½-in. double strip	78.25 to $78.75	71.25
¾-in. single strip	100.00	75.00 to 85.00
¾-in. double strip	105.00	93.00 to 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
⅜	$0.05½	1	$0.25
½	.06	1¼	.33
⅝	.09	1½	.40
¾	.12	1¾	.47
⅞	.15	2	.55
1	.18	2½	.65

NET PER 1000 FT.—NEW YORK

	Less Than $15 List	$15 to $60 List	$60 to $150 List
⅜-in.—	35.00–55.00	24.45–32.00	21.50–29.00
½-in.—	40.00–60.00	27.00–35.00	23.50–32.00

NET PER 1000 FT.—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
⅜-in.—	$60.00	$30.00	$26.50
½-in.—	65.00	33.50	29.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
¼	$0.08½
⅜	.08½
½	.08½
¾	.11½
1	.17
1¼	.23
1½	.27½
2	.37½
2½	.58½
3	.76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
¼	$0.05	$0.19
⅜	.06	.19
½	.07	.19
¾	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.50
2	.28	1.10
2½	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	7% to 12%	9% to 14%
2500 to 5000 lb.	10% to 15%	12% to 17%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ½ In.	¾ to 3 In.
Less than 2500 lb.	1.5% to 6.8%	3.5% to 8.8%
2500 to 5000 lb.	4.5 to 10.7%	6.5% to12.7%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$5.00 to $6.00
Discount	30%

CHICAGO

List price	$6.00 to $7.00
Discount	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30% to 31%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$5.00 to $6.00
1/5 to std. pkg	4.50 to 5.25

Standard packages, 500. List, each $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$7.00
1/5 to std. pkg	5.75

Standard packages, 500. List, each, $0.07

LAMPS, MAZDA OR TUNGSTEN

105 to 125 Volts

Regular, Clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.30
60-watt—B	100	.35
100-watt—B	24	.70
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round Bulbs, 3½-in., Frosted:		
15-watt—G 25	50	.53
25-watt—G 25	50	.55
40-watt—G 25	50	.55
Round Bulbs, 3½-in., Frosted:		
60-watt—G 30	24	.77
Round Bulbs, 4½-in., Frosted:		
100-watt—G 35	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$20.20—$35.90
Coil to 1000 ft	26.95— 27.18

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$35.00
Coil to 1000 ft	26.00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24.00

CHICAGO

Net per 100	$21.75 to $30.00

OUTLET BOXES

Nos.	List, Per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	25% to 33%	20% to 27%
$10.00 to $50.00 list	42%	37%

DISCOUNT—CHICAGO

	Black	Glavanized
Less than $10.00 list	30% to 40%	20% to 35%
$10.00 to $50.00 list	40% to 50%	30% to 45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$21.00 to $38.00
1/5 to std. pkg	17.85 to 19.00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$16.80
1/5 to std. pkg	15.80

Standard package, 2200. List per 1000, $20.00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std. Pkg. 3500 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg	$16.00 to $20.20	$32.00
1/5 to std. pkg	13.60 to 15.60	27.20

CHICAGO

Per 1000 Net.	Std. Pkg. 3500. 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg	$11.70 to $24.00	$33.85
1/5 to std. pkg	10.15 to 20.00	26.60

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0.33
½-in. cap keyless socket	500	.30
½-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+10% to 10%
1/5 to std. pkg	5% to 8%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	List
1/5 std. pkg	16⅔%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	$0.42
60-amp. S. P. S. T.	.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+5% to Net
$10 to $25 list	11% to 15%
$25 to $50 list	14% to 20%
	Low Grade
Less than $10 list	5% to 10%
$10 to $25 list	16% to 25%
$15 to $50 list	24% to 28%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+15% to +5%
$10 to $25 list	List to 11%
$25 to $50 list	5% to 14%
	Low Grade
Less than $10 list	+5% to 5%
$10 to $25 list	8% to 16%
$25 to $50 list	16% to 24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+10%
1/5 to std. pkg	5% to 8%
Std. pkg	23% to 25%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20% to 10%
1/5 to std. pkg	List to 16⅔%
Std. pkg	25%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	Net to 40%	Net to 30%
$2.00 to $10.00 list	10% to 50%	5% to 40%
$10.00 to $50.00 list	20% to 60%	10% to 52%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	25% to 40%	20% to 30%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$6.00
Discount	30%

CHICAGO

List price	$6.35 to $7.00
Discount	25% to 30%

WIRE ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.434—$0.51
No. 18, full spools	.384— .49

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.65 to $0.69
No. 18, full spools	.55 to .575

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net—		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$15.00–$20.00	$15.00–$15.00	$11.25–$12.00
12	21.29– 27.10	19.35– 23.20	$17.05– 17.42
10	29.70– 37.80	27.00– 32.40	23.75– 24.30
8	41.91– 53.35	38.10– 45.70	33.35– 34.29
6	60.30– 84.40	54.27– 72.35	51.55– 53.05

CHICAGO

	Price per 1000 Ft. Net—		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$21.00–$22.00	$16.00–$22.00	$13.25–$16.50
12	28.70– 29.46	28.70– 29.46	24.50– 25.54
10	40.10– 41.10	40.10– 41.10	34.23– 34.62
8	56.50– 57.90	48.23– 57.90	41.34– 50.18
6	85.31– 91.18	77.84– 85.31	66.72– 72.27

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$37.75 to $38.40
25 to 50 lb	36.40 to 37.75
50 to 100 lb	32.40 to 36.75

CHICAGO

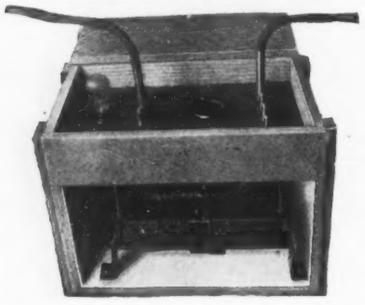
	Per 100 Lb. Net
Less than 25 lb	$37.00 to $39.72
25 to 50 lb	36.00 to 38.72
50 to 100 lb	35.00 to 37.72

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Alternating-Current Electric Welder and Cutter

Economy, efficiency and portability in cutting and welding are claimed for the use of an alternating-current electric arc welder manufactured by the Electric Arc Cutting & Welding Company, 222 Halsey Street, Newark, N. J. The machines manufactured by this



MACHINE MAY BE EASILY LOCATED IN ANY POSITION

company are designed for use with alternating current and consist of a special transformer with no moving parts. It is claimed that this machine will last indefinitely and that it will accomplish as much as, if not more than, the direct-current-type welder. The temperature and the amount of heat at the arc can be varied to suit the proper melting points of nearly all metals.

The ideal condition for electric arc welding is the absolute control of heat conditions, which is accomplished with this machine, says the maker, automatically and unchangeably for any given setting through the use of an easily moved shunt in the magnetic circuit. This enables the operator to take care of conditions requiring various amounts of heat at varying temperatures. The efficiency of this type of electric arc machine is higher than that secured from any other type of electric cutting and welding machines, because the loss in power wasted is minimum. The weight of this machine complete with all accessories necessary for work is about 200 lb. (181.4 kg.), and two men can easily set it up in any desired location. The over-all dimensions are 2 ft. by 2 ft. by 2 ft. (61 m. by 61 m. by 61 m.). No moving parts are employed, which means there is no maintenance cost. It will operate in any position or location and is designed to meet any power supply. An expensive wiring system is not required because the ordinary power circuit is sufficient. This machine is especially recommended by the maker for use on boiler construction and repairs, ship construction and repairs, locomotive construction and repairs, tank manufacturing and repairs, pipe manufacturing, automobile construction, railroad line work and cutting of shell stock by nicking and kindred uses.

Marine Receptable for Three-Blade Plug

A watertight junction box for a three-blade plug with a screw cap for marine work has recently been placed upon the market by the Benjamin Electric Manufacturing Company, 806 West Washington Boulevard, Chicago, Ill. As shown in the accompanying illustration, the removal of this cap enables the use of a watertight attachment plug for a

METAL PARTS ARE ALL OF CAST BRASS IN THIS DEVICE

portable device of any kind on shipboard. The metal parts are all of cast brass and the interior portions are of molded insulating material. The whole apparatus is constructed especially for the stress of marine service.

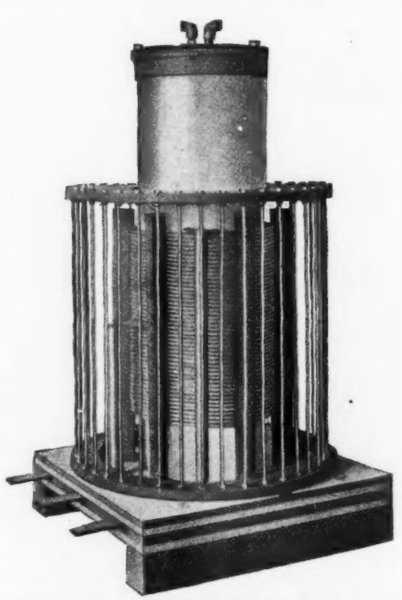
High-Frequency Induction Furnace

A furnace which is a radical departure from the usual furnace design has been developed by Dr. E. F. Northrup, with the aid of facilities afforded by the Palmer physical laboratory of Princeton University for the Ajax Metal Company of Philadelphia. It is primarily intended for the heat treatment of materials where quantity production is contemplated, but as this furnace in small units is also adapted to laboratory and scientific purposes, arrangements have been effected with the Ajax Metal Company whereby furnaces of a rating of 20 kw. and under are manufactured and marketed by the Pyrolectric Instrument Company of Trenton, N. J.

The operation of the furnace depends upon utilizing the powerful inductive effects obtainable by the employment of high-frequency currents. In the furnace now being marketed the high-frequency current is obtainable by the oscillatory discharge of a bank of condensers. By reason of the highly effective induction possible, when using oscillatory currents, it becomes unnecessary, the designers think, to make use of an iron magnetic circuit such as is employed in all other types of induction furnaces. The currents which produce the heating are set up in the walls of the containing crucible or in the melt itself, if this has sufficient conductance to permit the flow of currents. A crucible containing the melt is surrounded by a coil of some fifty to seventy turns of copper wire, which constitutes the inductor winding.

This inductor winding, which carries current of a frequency of from 10,000 to 20,000 cycles, constitutes one of the main features of the furnace.

The electrical connections are as follows: A transformer steps the line voltage, which may be 110, 220 or 440 volts, 60 cycles, up to about 8000



INDUCTOR COIL INCLOSED IN GROUNDED CAGE AFFORDS PROTECTION

volts. The condenser is charged at this high voltage and discharged through a double gap and through an inductor winding, which surrounds the crucible. There is a reactance in shunt with the

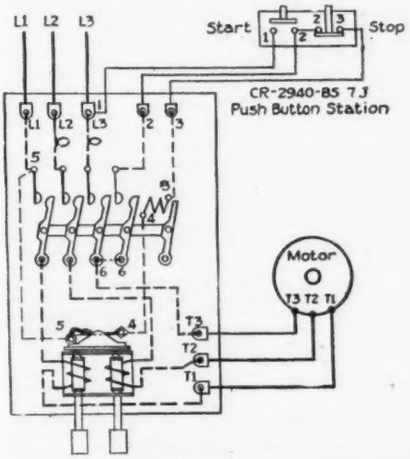
primary of the transformer which serves the purpose of adjusting the power factor of the supply line to near unity, and there is an adjustable reactance in series with the supply line which regulates, without waste of energy, the input of power. The inductor winding is electrically insulated from the crucible, in the case of a non-vacuum metal melting furnace, by a cylinder of "micanite."

In the illustration there is shown a furnace of the vacuum type adapted to produce melts in a crucible of approximately 6 in. (15 cm.) diameter by 12 in. (30 cm.) high. In a furnace of this construction and these dimensions a temperature of not less than 1600 deg. C (2912 deg. Fahr.) may be obtained with an input of 10 kw. as measured at the switch terminals.

The furnace has been developed for operation on either single-phase or polyphase circuits, and a furnace absorbing as much as 60 kw. has been in successful operation for some time. The Pyrolectric Instrument Company, however, at the present time is marketing single-phase furnaces in the following sizes only: 6 kw., 8 kw., 12 kw., 16 kw., and 20 kw.

Remote-Control Starters For Squirrel-Cage Motors

In order to meet a demand for a device for starting small induction motors from remote points by throwing them directly across the line the General Electric Company, Schenectady, N. Y., has recently developed and placed upon the market such a starter, known as the CR-7006 remote-control switch, arranged for push-button control. This starter is applicable for use with motors up to and including 5 hp., 110 volts, and 7½ hp., 220, 440 and 550 volts. In addition to its starting function it provides protection against under-voltage



FRONT VIEW OF PANEL AND CONNECTIONS OF REMOTE-CONTROL SWITCH

and overload. The cover of the inclosing case is furnished with a hasp so that if desired it can be locked in a closed position by padlock.

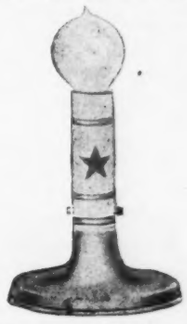
The device consists of a 25-amp., three-pole contactor with two inverse-time-limit gravity-reset overload relays mounted on a slate base totally inclosed in a strong sheet-iron case.

A small "start and stop" push-button station is used as a remote-control switch. Completion of the starting circuit by pressing the "start" button energizes the coil of the magnetically operated switch, which closes the contacts and throws the motor directly on the line. Interruption of the circuit or a radical decrease in voltage permits the contacts to reopen by gravity, thus stopping the motor, which cannot start again until the "start" button is pressed.

The overload relays can be adjusted for various values ranging from normal up to 50 per cent above normal. They can also be adjusted over a wide range of time values. The relay trips automatically and rests by gravity.

Candlesticks with Service Stars

Under the trade name "Service Sticks," the Beardslee Chandelier Manufacturing Company, 216 South Jefferson Street, Chicago, Ill., is now manufacturing four types of red, white, and blue candlesticks decorated with service stars. The different styles are all made of brass metal, four being finished with baked enamel and one with a rose gold finish. They range in height from 9 in. to 13½ in. (22.8 cm. to 34.2 cm.) over all. Linen or silk shades can be supplied with the units. They are sold wired with candles, sockets, plugs and 6 ft. (1.8 m.) of silk cord, but bulbs are not included. These units are designed for the mantel, dressing table, buffet or window of the home.



STEEL METAL CANDLESTICK WITH ROSE GOLD FINISH

Vertical-Arc-Type Electric Furnace

For melting down cold charges for steel-casting foundries, the Booth-Hall Company, 505 West Washington Boulevard, Chicago, Ill., has designed an electric steel furnace of the vertical-arc type with conducting hearth having two main and one auxiliary electrode. This furnace is adapted to give a balanced load on a three-phase circuit, but also built for two-phase or single-phase circuits. The furnace has a solid hearth which becomes conductive of electricity when hot, and the use of an auxiliary electrode which acts as a return for the electric current until the hearth becomes heated and conductive. Two sets of grids embedded in the hearth of the Booth-Hall two-phase electric furnace are electrically insulated from each other and are related to the main electrode so that the currents of the two phases cross in the bath, this giving a maximum of circulation of the molten metal.

With the two-phase electric furnace a minimum of electrode consumption is secured due to the fact that a minimum number of electrodes for a balanced polyphase load is used. This insures fewer electrodes to handle, less electrode breakage and less surface burning. The loss on the auxiliary electrode is small, because it is in operation for such a comparatively short time. The electrode jaws are made so that the electrodes can be gripped or released by turning a handwheel or lever at the side of the furnace, and therefore it is not necessary for the melter to climb on top of the furnace when changing the grip on the electrodes. These jaws are arranged in segments so as to adjust themselves to the inaccuracies in the surface of the electrodes.

The furnace tilts or rocks backward as well as forward, and slagging operations can be handled either from the rear or front. Air is prevented from getting into the furnace and excessive losses of heat are eliminated through the door because it comes flush against the door frame, thus sealing the opening and preventing it from swinging open of its own accord. The main electrodes are arranged for automatic regulation and can be regulated by hand in case the regulators or motors should require repair.

Weather-Proof Snap-Switch Fitting

The Appleton Electric Company of Chicago has designed the fitting shown herewith to meet the demand for absolute water-proof protection for snap switches. The bridge in the fitting permits of mounting any 5-amp. or 10-amp. switch. The fittings are complete with flanged hood, rubber gasket and all necessary fastening screws. Ample room is allowed around the switch handle for convenient use. When a lock switch is desired the switch handle may be removed and replaced with lock attachment. Extension stems are furnished for use with Perkins switches, but stems for the other makes can be furnished if the make is specified.

5-AMP. OR 10-AMP. SWITCH MAY BE MOUNTED ON THIS FITTING

Trade Notes

Government Contracts

The following contracts have been placed by government purchasing officials for electrical supplies and equipment:

HARDWARE AND METALS DIVISION, QUARTERMASTER'S DEPARTMENT.—Aug. 22, Westinghouse Electric & Manufacturing Company, Washington, D. C., motor.

QUARTERMASTER UNITED STATES MARINE CORPS.—Aug. 16, F. H. Stewart Electric Company, Philadelphia, Pa., electrical supplies; Aug. 21 and 22, Western Electric Company, Atlanta, Ga., copper wire, copper conductor, rigid conduit, switchboard.

NAVY DEPARTMENT, BUREAU OF SUPPLIES AND ACCOUNTS.—Aug. 19, Westinghouse Electric & Manufacturing Company, Washington, D. C., motors; R. P. Andrews Paper Company, Washington, D. C., binders; Manhattan Electric Supply Company, New York City, dry cells; Crouse-Hinds Company, New York City, electrical materials; Bailey Electric Supply Company, New York City, electrical materials; Hi Po Waterproof Battery Company, South Norwalk, Conn., dry cells; Bourn Rubber Company, Providence, R. I., electrical insulated wire; Essex Rubber Company, Trenton, N. J., rubber bushings; W. S. Electric Tool Company, Cincinnati, Ohio, electrical grinders. Aug. 20, Ward Leonard Electric Company, Mount Vernon, N. Y., rheostats; General Electric Company, Schenectady,, N. Y., radio materials; J. A. Roebling's Sons Company, Trenton, N. J., electric wire; Western Electric Company, New York City, cable ships' light; Westinghouse Electric & Manufacturing Company, Washington, D. C., powder hoists. Aug. 21, Machine Company of America, Big Rapids, Mich., radio material; General Electric Company, Washington, D. C., logs; Radio Telegraph & Telephone Company, New York City, radio sets; Electric Boat Company, Groton, Mass., batteries.

NEW SOUTH WALES BARS AMERICAN WIRE.—The Fire Underwriters' Association of New South Wales has made the following ruling with regard to American wire. "To enable local firms holding stocks of insulated wire manufactured in the United States of America to dispose of the same, the note to Rule 37, page 2, 1912 Rules, will be deemed in force until Oct. 1, 1918." This means that an embargo is virtually placed on American-made wire in this British colony.

ALL CABLEGRAMS AFTER OCT. 1 TO BE IN PLAIN LANGUAGE.—The Censorship Board has authorized the following announcement: "On and after Oct. 1, 1918, no confirmation of a cablegram shall be allowed to leave the United States, its territories or possessions unless it be in plain language. On and after Nov. 1, 1918, no confirmation of a cablegram shall be allowed to enter the United States, its territories, or possessions unless it be in plain language. It is to be noted that code confirmations will not be passed by postal censorship even when accompanied by what purports to be or actually is a translation thereof."

RULING AGAINST GIVING GRATUITIES.—The Federal Commission has ordered the Dearborn Chemical Company of Chicago to discontinue the practice admitted to have been employed by some of its salesmen of giving gratuities, such as liquor, cigars, meals, entertainments, souvenirs, etc., to employees of its customers and prospective customers with a view to influencing the purchase of supplies. The company, which manufactures boiler compounds, chemicals and preparations for the treatment and preservation of steam boilers, admitted further to have spent money for the entertainment of customers. The company accepted the issuance of the commission's order without presentation of testimony in support of the practice.

GERMAN ELECTRICAL WORKS TO HAVE SWEDISH FACTORY.—The Allgemeine Elektricitäts Gesellschaft, which is one of the largest industrial institutions of Germany, purchased in Malmo, in the south of Sweden, according to a recent report of Consul General Albert Halstead before the war, ground for the purpose of erecting a factory and manufacturing electrical products for the Swedish market, so as to avoid the Swedish tariff. The war necessitated the abandonment of the original plan. Now, according to the *Svensk Handelstidning* of July 28, 1918, a factory is to be erected at a cost of over $2,000,000. Under the Swedish law the company running the factory must be a Swedish concern and subjects of Sweden alone may be officers of the company. The capital will, however, be German.

PROHIBITED FRENCH EXPORTS.—Since the commencement of the war various orders have been issued by the French government imposing prohibitions on the exportation from the country of certain materials. The British Board of Trade *Journal* has just published a complete list of the prohibition orders at present in force in France, from which the following list of electrical goods is taken: "Electrical apparatus materials and parts adapted for use in war, dynamo-electric machines, magnet accumulators and accumulator plates, electric batteries and their elements, telegraphic apparatus, land, submarine, and wireless; carbons and other electrodes for electrical purposes, carbon brushes for dynamos, cables and insulated wire for electrical purposes, ebonite and vulcanized fiber."

CUTTING STANDARD ADVERTISED PRICES DECLARED A FRAUD.—An important decision which may have an effect on the price of electrical goods, and in particular those priced by the manufacturer for retail sale, has just been handed down by Vice-Chancellor Lane of the New Jersey Court in Chancery restraining the Hahne company, a Newark department store, from selling trademarked watches manufactured by Robert H. Ingersoll & Brothers at less than standard advertised prices. The decision is important in its possible bearing upon the interpretation of the Sherman and Clayton anti-trust acts. A practice of selling below the manufacturers' stipulated price was declared by the court to be in effect a fraud upon the public. This fraud the court defines as an intention by the defendant company to sell the watches under price in order to lead the public into believing that all the goods sold in its store were similarly low-priced.

IMPORTANT SWEDISH TELEPHONE AND WIRE MERGER.—*The Affarsvarlden*, a Swedish trade journal, for July 10, 1918, reports the consolidation of the Aktiebolaget L. M. Ericsson & Company and Stockholms Allmänna Telephone Company, stating, according to Consul-General Albert Halstead: "The two Swedish telephone companies have been combined in order to meet expected competition and possible business extensions after the war. The Aktiebolaget L. M. Ericsson & Company mainly manufactures telephone instruments and materials, while the Stockholms Allmänna Telephone Company installs and maintains the wires. The latter company also has concessions for wires in other countries." The Stockholms Allmänna Telephone A. B. recently sold its wires with certain properties to the government, but its factory will continue to manufacture materials for the government for the next five years. It has also recently established a factory for manufacture of cables. Aktiebolaget L. M. Ericsson & Company employs about 1500 men in Stockholm, 3000 in England, America and Austria-Hungary, and under normal conditions 3000 in Russia. Besides telephone materials, it makes electric meters, magnetic spark plugs, etc. Its branch in Russia used to be a great enterprise, that country absorbing the plant's entire output. Its main competitors in Russia are the Germans. The largest branch of the Ericsson company is in England, where it employs 1000 persons, with a market in England and its colonies. However, its export trade is almost closed on account of England's consuming all its output. The Ericsson company's branches in Vienna and Budapest manufacture mostly telephone instruments. Its branch in France is of recent origin and is much hampered on account of the shortage of labor.

THE WESTERN ELECTRIC COMPANY has leased the property at 400 West Fourtennth Street, New York City, having a floor area of 10,000 sq. ft., to provide for extensions.

THE CROUSE-HINDS COMPANY, Syracuse, N. Y., is said to have acquired property adjoining its plant on Wolf Street for the construction of an extension. An addition to the company's works has recently been completed.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, East Pittsburgh, Pa., has commenced the erection at its works of a new four-story and basement office building, 34 ft. by 96 ft., to cost about $50,000.

THE AJAX ELECTRIC SPECIALTY COMPANY, St. Louis, recently incorporated, is planning for the early operation of a plant for the manufacture of electric flashlamps, plural plug sockets, and kindred specialties. The company will be located at 1408 Morgan Street.

THE ELECTRICAL SALES COMPANY, 176 Federal Street, Boston, has moved its Chicago office from room 536 to room 1946 in the People's Gas Building. Edward E. Williams is manager of the company's Chicago office. This concern is the sole distributer for Schwarze bells.

THE TORRINGTON COMPANY, National Sweeper Division, is adding Charles J. Blout to its sales department in charge of advertising on Torrington cleaners. Mr. Blout comes from Denver, Col., having previously been associated with sales work of the company in that territory.

THE CHARLES T. TOPPING MACHINERY COMPANY has merged its interest with the Pittsburgh office of the Lakewood Engineering Company, Cleveland, Ohio, manufacturer of "construction plant" and "industrial haulage." The address of this office is 411 Fulton Building.

THE HAYWARD COMPANY, 50 Church Street, New York City, will have in operation at the foundrymen's convention, to be held at Milwaukee in the week beginning Oct. 7, an electric motor bucket. The exhibit, which will include other working models, will be in charge of C. F. Hutchings and H. M. Davison, sales engineers.

THE LIVE WIRE SUPPLY COMPANY, Macomb, Ill., has been awarded a contract to build a transmission line from Dallas City to Blandinsville and Stronghurst, Ill., for the Western Illinois Utilities Company of La Harpe, Ill. The Utilities company will furnish the material for the line, which is 44 miles long. W. I. Savidge is president of the Live Wire Supply Company.

THE NATIONAL MACHINERY & WRECKING COMPANY, 1914-18 Scranton Road, Cleveland, Ohio, which has been in business for the past fifteen years, has been incorporated under the name of the National Power Machinery Company. The company will continue to handle new and used power machinery. A contract has just been let for a new warehouse in addition to the three now in use.

THE BATES EXPANDED STEEL TRUSS COMPANY, 208 South LaSalle Street, Chicago, is distributing about 7000 glass paperweights which bear small pictures of a Bates one-piece steel pole in combination light and traction service. These paperweights are being given to the principal officials and department heads of various utility companies. A. J. Bates, secretary of the Bates Expanded Steel Truss Company, has stated that they will be furnished gratis to utility men who apply for them.

PAUL TAFEL, president of the H. C. Tafel Electric Company of Louisville, left recently for Washington to enter the electrical department of the construction division of the Quartermasters' Corps. Mr. Tafel had been rejected for active military service, but felt he could be of value in the Quartermaster's Corps and therefore tendered his services to Washington for duties there. He is the eighth man from the Tafel Electric Company to enter the service, the others being Lieut. Robert Tafel with the Signal Corps, Frank T. Kent and William Keuhn in the navy, Louis H. Miller and Banks Kincaid with infantry regiments, Arthur Ochs with the Quartermasters' Corps, and Lowery Marks with the artillery.

GEORGE E. PINGREE, managing director of the London Allied Company of the Western Electric Company, has returned to New York. In the absence of Gerard Swope, vice-president and general sales manager, who has been called to Washington on government business, Mr. Pingree will take up that part of his work which has to do with foreign and export business. Mr. Pingree was first employed by the Western Electric Company in 1903, when he started in financial work at Chicago, and for the next three years held various positions in Chicago, Cincinnati and New York, becoming assistant treasurer in 1907. The next year he was made telephone sales manager, and in 1909 he was sent to China as a special agent. That same year he went to London as manager and three or four years later become managing director of the London house. A short time ago Mr. Pingree was appointed by Dr. Addison, Minister of Reconstruction, to serve on the electrical branch or the engineering trade.

Trade Publications

VACUUM CLEANERS. — The Cadillac vacuum cleaner is described in a circular issued by the Clements Manufacturing Company, 601 Fulton Street, Chicago.

RENEWABLE FUSES. — The Volk Manufacturing Company, Westport, Conn., has issued a price list of its ferrule and knife-blade types of renewable fuses.

MOTION-PICTURE PROJECTOR. — "Economical Projection" is the subject of a circular issued by the Nicholas Power Company, Inc., 90 Gold Street, Chicago.

FACTORY BUILDINGS. — The Austin Company, 16112 Euclid Avenue, Cleveland, Ohio, industrial engineer and builder, has issued a bulletin on standard factory buildings.

CONSULTING ENGINEER. — "Building a City" is the title of a four-page circular being distributed by the Westinghouse-Church-Kerr Company, Inc., 37 Wall Street, New York City.

DISCONNECTING HANGERS. — The Thompson Electric Company, 5606 Euclid Avenue, Cleveland, Ohio, has issued a circular entitled "Why Waste the Light Your Lamps Are Producing?"

VACUUM CLEANER.—A new Bissell Cleaner Model D with aluminum frame is described and illustrated in the circular just issued by the F. Bissell Company, 226 Huron Street, Toledo, Ohio.

BELL-RINGING TRANSFORMERS. — The Cumberland Electric Manufacturing Company, Inc., Memphis, Tenn., is distributing a circular describing and illustrating its "Imperial" bell-ringing transformer. This is the light-weight pressed-steel style.

COMPENSATOR FOR MOTION PICTURE PROJECTION.—Type I Form B "Compensarc" for motion picture projection is described and illustrated in a circular, B-3471, being distributed by the General Electric Company, Schenectady, N. Y.

OUTDOOR SUBSTATIONS.—The Delta-Star Electric Company, Chicago, has issued a four-page circular showing several types of construction of its steel-tower outdoor substation. General specifications and material furnished with these tower stations are also given.

COAL CONVEYOR.—John F. Godfrey, Elkhart, Ind., has issued a circular descriptive of his coal conveyor. Standard installations of this conveyor are illustrated in a diagram, and the ease with which coal can be stored or carried to the boiler house is shown.

INDUSTRIAL LIGHTING UNIT. — "Scientific Industrial Illumination" is the title of a thirty-six-page illustrated booklet discussing a new industrial lighting unit which has been placed upon the market by the Holophane Glass Company, Inc., 340 Madison Avenue, New York.

BALL BEARINGS.—Dragon ball bearings are discussed in a bulletin recently issued by the Fafnir Bearing Company, New Britain, Conn. The design, advantages, applicability and quality of these bearings are given in full. Tables of the load-carrying capacity in pounds at various speeds are given for light, medium and heavy series.

LABOR-SAVING TOOLS.—The Independent Pneumatic Tool Company, 600 West Jackson Boulevard, Chicago, has issued a four-page folder which gives an excellent array of complete data on its pneumatic and electric tools. Drills, grinders, hammers and sand rammers are featured. A valuable part of the publication is a complete table of data giving description, capacity, ratings and applications of the different styles and types of drills.

POWER PUMPS.—Vertical triplex power pumps, single and double acting, are described and illustrated in a booklet D-702 issued by the Worthington Pump & Machinery Corporation, 115 Broadway, New York. The pumps are manufactured at the Deane Works, of Holyoke, Mass. The bulletin illustrates very clearly the details of construction of the Deane of Holyoke triplex power pump. The construction and parts of these pumps are explained in detail and the sizes of the various pumps are listed and described.

SAFETY SWITCHES.—Inclosed switches externally operated for safety service are described and listed in a bulletin just issued by the Trumbull Electric Manufacturing Company, Plainville, Conn. The advantages of these switches enumerated are elimination of fire hazard, minimization of danger of electric shock, convenience, saving time and trouble, and that they can be installed in places where an open switch cannot.

HEATING APPLIANCES. — The G-E Division of the Edison Electric Appliance Company, Inc., Chicago, Ill., has issued a catalog describing and illustrating its line of heating appliances. A new air heater manufactured by this company is shown in this bulletin. One department is given on "Ranges Make Possible the Matchless Kitchen" in which several types of ranges are shown. Circulating-water heaters are also illustrated and described.

HYDRAULIC TURBINES.—The Trump Manufacturing Company, Springfield, Ohio, is distributing a booklet describing and illustrating its hydraulic turbines in steel and open flumes. A diagram showing the correct setting of a vertical turbine directly connected to an electric generator is given. The importance of water-power development is discussed and some special types of turbines are illustrated. Several illustrations are given showing the different ways of installing hydraulic turbines.

MARINE LIGHTING AND SIGNALING APPARATUS.—This is a title of a catalog just issued by Benjamin Electric Manufacturing Company, Chicago, Ill. This comprehensive catalog includes marine fittings such as watertight junction boxes, connecting blocks, receptacles, switches and attachment plugs, and marine lighting fixtures, drop fixtures, hand portables and watertight shade holders, and parts for marine devices. Signaling apparatus, such as watertight and non-watertight buzzers, bells, gongs, horns and push buttons, are also listed in one section.

SOLENOIDS.—"C-H Ironclad Solenoids" is the title of a descriptive bulletin, known as Booklet "F," being distributed by the Cutler-Hammer Manufacturing Company of Milwaukee. The booklet describes the construction of these solenoids and points out such advantageous features as the floating plug which gives the solenoid a high sealing pull without objectionable hammer blow, the connecting rod for attachment to the load to be lifted, which eliminates the necessity of accurate alignment, and the absence of excessive side pull on the plunger due to the patented equalized bushing.

PULL SWITCHES.—"War-Time Control of Light" is the title of a four-page envelope folder, known as publication 271, being distributed by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis. This folder points out that energy, copper and coal may be saved by the judicious use of pull switches properly placed, thus permitting lights not needed to be promptly cut out of circuits. "C-H" pull switches have a rating of 6 amp. at 125 volts, which is said to make them of particular value for controlling large groups of lamps, as for instance for indirect lighting units where a switch of only 3-amp. rating would be of insufficient capacity.

ALUMINUM WIRE AND CABLE. — "From the Falls to the Factory" is the title of a treatise on electric power transmission recently published by the British Aluminium Company, Ltd., 109 Queen Victoria Street, London, England. This publication has been designed with special reference to American practice in transmission line engineering. Nevertheless there is no wide divergence in practice in different parts of the world and the bulletin should prove beneficial to any one interested. It is divided into seven parts which are "Transmission Line Design," Conductance and Tenacity of Aluminum," "Tension and Sag Problems," "Spans and Supports," "Aluminum Steel Cables," "Construction and Costs," "Modern Transmission Lines" and "Tables and Data." Under these main heads is discussed the historical side of transmission lines, the preliminary design, voltage, corona losses, standard resistivity of copper and aluminum at 20 deg., tensile strength of aluminum, physical properties of copper and aluminum, working tension, ice and wind loads, safety factors, sags, span length, extra-long spans, extra-long transmission line spans, wood poles, steel towers, properties of steel-core aluminum cables, joining of aluminum cables, effect of temperature on the tension, cost estimates, data for estimating the weights of steel towers, total steel per mile of line of a transmission line. Under the heading of "Modern Transmission Lines" actual installations showing the towers and lines are illustrated and the main essentials produced. The tables in the book give the various dimensions and notes on aluminum cables. The tables on "Minimum Corona Voltages" should prove valuable to anybody interested in the design of transmission cables.

New Incorporations

THE GOFF MANUFACTURING COMPANY of Collingswood, N. J., has been incorporated by O. P. Wheaton and F. H. and Howard E. Goff. The company is capitalized at $250,000 and proposes to manufacture electric brakes, etc.

THE NICHOLSON POWER DEVICES COMPANY has filed articles of incorporation with a capital stock of $200,000 under the laws of the State of Delaware. The incorporators are Samuel C. Wood and Arthur M. Brady of Chicago, Ill.

THE RYAN MANUFACTURING COMPANY of New York, N. Y., has been incorporated with a capital stock of $10,000 by W. S. Ryan, D. J. Dowling and C. S. Ashley, 15 John Street, New York, N. Y., to manufacture automatic cut-out switches, etc.

ELLIS & HOWARD, Ltd., of Kitchener, Ont., Can., has been incorporated by Frank O. Ellis, Samuel F. and Walter H. Howard and others. The company is capitalized at $40,000 and proposes to manufacture electrical machinery, equipment, supplies, etc.

BEATTIE McINTYRE, Ltd., of Toronto, Can., has been chartered with a capital stock of $40,000 by John D. McNabb, 141 Browning Avenue; George A. Robinson, Stuart P. Reesor and others. The company proposes to manufacture electrical machinery, equipment, etc.

THE MISSISSIPPI RIVER TRANSPORTATION COMPANY of Augusta, Me., has been incorporated by C. L. Andrews, R. W. Farris and M. E. Hearin of Augusta, Me. The company is capitalized at $3,000,000 and proposes to build and operate all kinds of public works, street railways, water, gas and electric works, etc.

THE U-NEED-IT DRY STORAGE BATTERY COMPANY of New York County, N. Y., has been incorporated with a capital stock of $75,000 to manufacture and deal in dry storage batteries, etc. The incorporators are E. Leighton, A. H. Jacobson, 337 Pelham Road, New Rochelle, and J. J. Friedman, 966 Hoe Avenue, Bronx.

THE MOOREHEAD RADIO CORPORATION has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $1,000,000 to manufacture and deal in electrical and magnetical mechanical contrivances of all kinds. The incorporators are C. L. Rimlinger, F. A. Armstrong and B. A. Spangler of Wilmington.

THE NEW JERSEY MACHINE CORPORATION of Hoboken, N. J., has been incorporated with a capital stock of $50,000 by M. Gailbert of New York, N. Y.; Martin Feybusch of Sea Cliff, N. Y.; J. D. Reifsnyder of Weehawken and W. B. Devoe of Upper Montclair, N. J. The company proposes to manufacture motors, dynamos and other machinery.

THE LANGER WATER-POWER EXTRACTING COMPANY of New York County, N. Y., has been incorporated with a capital stock of $100,000 to manufacture machinery. The incorporators are: T. Howard, 1755 Madison Avenue, New York City; M. Langer, 96 Manhattan Avenue, Jersey City, N. J., and M. Wyner, 1970 Mapes Avenue, Bronx.

THE WILSON WELDING REPAIR COMPANY of New York, N. Y., has been chartered with a capital stock of $50,000 by F. E. Hasler, D. H. Wilson, Jr., and H. F. Bertine, 2 Rector Street, New York City. The company proposes to do a general electric welding business, manufacture welding and cutting machines and deal in motor trucks, engines, foundry and factory supplies.

THE KENMORE MACHINE MANUFACTURING COMPANY of New York, N. Y., has been chartered by E. M. Morrison, 2 Rector Street; F. H. Waring, 6 Church Street, New York, and E. Claus, 15 Sixty-seventh Street, Brooklyn. The company is capitalized at $30,000 and proposes to manufacture machinery, engines, lathes, tools, etc., and to do a general contracting, mechanical and electrical engineering business.

New England States

BOSTON, MASS.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 15 under Proposal 1951 for generating plant, oxygen, hydrogen and electrolytic, at Boston, Mass.

WEST DUDLEY, MASS.—The Burmas Paper Company is planning to enlarge its plant to four times its present capacity. The proposed improvements include the construction of a hydroelectric power plant to develop 500 hp., utilizing all the water power on the Quineaug River at this point. The cost of the plant is estimated at about $50,000.

WORCESTER, MASS—Ground has been broken for the erection of a new plant at Union and Central Streets for the United States Light & Heat Company of Niagara Falls, N. Y.

NORTH SMITHFIELD (WOONSOCKET P. O.), R. I.—Contract has been awarded by the Andrews Mills Company of Branch Village to the C. I. Bigney Construction Company, 898 Westminster St., Providence, for constructing two-story weave shed, 174 ft. by 220 ft.; boiler house, 24 ft. by 36 ft.; power house, 45 ft. by 60 ft., and recreation building, 45 ft. by 75 ft.; also a concrete dam, 80 ft. long by 18 ft. high, across Branch River, to cost about $265,000.

Middle Atlantic States

BROOKLYN, N. Y.—Contract has been awarded by the Columbia Machine Works & Malleable Iron Company, 269 Chestnut Street, to the Austin Company, 217 Broadway, New York City, for the erection of an addition to its plant, 80 ft. by 158 ft., on Euclid Avenue near Atlantic Avenue, to cost about $50,000. The company manufactures armatures and other electrical specialties.

BUFFALO, N. Y.—Contract has been awarded by the Wheat's Ice Cream Company to C. F. Ernst's Sons, 75 Lathrop Street, for the construction of a new power plant at its works on Hoag Avenue.

BUFFALO, N. Y.—The Prest-O-Lite Company of Indianapolis, Ind., it is reported, is preparing plans for the erection of a new plant at Colgate Avenue and Hopkins Street, consisting of four one-story buildings equipped for charging and other work.

BUFFALO, N. Y.—A permit has been filed by the Monarch Knitting Company of Buffalo for the construction of a boiler house, dye house and storehouse, to cost about $22,000. Plans have also been filed by the company for the erection of a two-story boiler plant, to cost about $60,000.

GLENFIELD, N. Y.—Application has been filed with the Public Service Commission by Hirschey & Lewis of Glenfield asking permission to construct an electric light plant in the town of Martinsburg under a franchise granted by the town authorities in August. The petitioners have a hydroelectric plant in Glenfield and also contemplate securing a franchise in the town of Greig.

THIELLS, N. Y.—Bids will be received by Frank A. Vanderlip, president board of managers of Letchworth Village, 7 Wall Street, New York City, until Sept. 27 for construction heating, plumbing and drainage work, completion of attendants' home and completion of Service Building, female group, Letchworth Village, Thiells. Drawings and specifications are on file in the New York office of the Department of Architecture, Room 1224, Woolworth Building, New York City, and the Department of Architecture, Capitol, Albany, where copies may be obtained. Lewis F. Pilcher is state architect.

WATERTOWN, N. Y.—Plans have been completed for the erection of a new municipal electric plant, to be located about 1½ miles from the city limits. A transmission and distribution system is included in the project. The cost of the entire work is estimated at about $300,000. Thomas L. Tomlines, City Bank Building, Syracuse, is engineer.

BAYONNE, N. J.—Contract has been awarded to Harry Alexandre, Inc., 20 West Thirty-fourth Street, New York, N. Y., for the installation of a new floodlighting system in the Constable Hook section, to cost about $18,000.

BLOOMFIELD, N. J.—The General Electric Company, it is reported, will soon ask for bids for the construction of a power house, 90 ft. by 190 ft., at its local works. C. G. Hulth, Watsessing Avenue, Bloomfield, is engineer.

JAMESBURG, N. J.—The Board of Freeholders has awarded the contract for work in connection with improvements in the electric and heating systems at the State Home for Boys to the Underground Specialties Company, 1476 Broadway, New York, N. Y. The cost of the work is estimated at $24,950.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

NEWARK, N. J.—Arrangements have been completed for the installation of new electric lamp standards on the series of new safety platforms for trolley stations to be constructed on the recommendation of the Board of Freeholders at Bloomfield Avenue, Bloomfield; Glen Ridge, Springfield and Irvington.

TRENTON, N. J.—Plans have been prepared by the M. M. S. Metal Company, foot of Fall Street, for the reconstruction of its smelting plant, recently destroyed by fire with a loss of about $25,000. The installation of electrically operated machinery, including engine plant, motors, etc., is contemplated.

TRENTON, N. J.—Contract has been awarded by the Department of Public Works to Harry E. Stahl, Goodwill Place, for the construction of a new electrically operated pumping station at the municipal waterworks, to cost about $150,000.

WEEHAWKEN, N. J.—Plans have been prepared for the constuction of a new plant for the Weehawken Tungsten Lamp Company, 50 ft. by 80 ft., to cost about $10,000.

BETHLEHEM, PA.—Permission has been granted the Lehigh Valley Transit Company by the Public Service Commission to make extensions to its lines in certain parts of the city.

MARIETTA, PA.—Preparations are being made by the Pennsylvania Railroad Company, Philadelphia, for the construction of new shops, including engine house, machine shop, car shop, etc., on a site recently acquired in Marietta.

PERRYVILLE, PA.—Contracts have been awarded by the Pennsylvania Railroad Company to the Roberts & Schaefer Company of Chicago, Ill., for the construction of 1000-ton reinforced-concrete electric locomotive coaling and sand plants at Perryville.

PHILADELPHIA, PA.—Plans are being prepared for the erection of two one-story battery houses to be used in connection with two signal towers at the Erie yards of the Philadelphia & Reading Railroad Company.

PHILADELPHIA, PA.—Plans have been filed by the Philadelphia Rapid Transit Company for extensions to its repair shops at Forty-ninth Street and Woodland Avenue, to cost about $45,000.

PHILADELPHIA, PA.—Plans have been prepared by the Philadelphia Electric Company for its proposed electric generating plant at Beach and Palmer Streets, to cost several million dollars. The Stone & Webster Engineering Corporation, 147 Milk Street, Boston, Mass., is engineer.

PITTSBURGH, PA.—Notice has been filed by the West Penn Power Company of a bond issue of $2,223,000, the proceeds to be used for proposed extensions to its plant and system.

RUTHERFORD, PA.—The Philadelphia & Reading Railroad Company is contemplating the construction of a new compressor plant at its local shops.

WILKES-BARRE, PA.—Notice has been filed with the Public Service Commission by the Wilkes-Barre Company of an issue of $200,000 in bonds for extensions and improvements to its system.

RICHMOND, VA.—The Virginia Baking Company contemplates the construction of a new boiler plant, 40 ft. by 75 ft., in connection with rebuilding its works recently destroyed by fire.

YORKTOWN, VA.—Bids are being received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of a fuel-oil plant at Yorktown, including boiler plant, heater houses, mechanical and electrical equipment, etc.

WASHINGTON, D. C.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is planning to erect marine hospitals at Baltimore, Md., Savannah, Ga., and New Orleans, La., each consisting of seven or eight buildings, to cost from $200,000 to $250,000 at each city.

WASHINGTON, D. C.—Bids will be received at the General Engineer Depot, United States Army, 1438 U Street, Washington, D. C., until Sept. 24 for furnishing 100 generator switchboards and accessories, under Proposal 1110. Bids will also be received under Proposal 1108 for 170 carriages for portable searchlights.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Eastern and Western yards, Schedule 5870½—hand portable electric lights; Schedule 5884½—11,000 snap switches; 5886½—distribution panels. San Francisco, Cal., Schedule 5893½—one 7½-hp. motor with control apparatus. Philadelphia, Pa., Schedule 5922½—14 searchlight trucks. Boston, Mass., Schedule 5925½—turbo-generator set. Brooklyn, N. Y., Schedule 5929½—10,000 ft. copper wire, 5946½—One 3-ton electric hoist. South Charleston, Schedule 5942½—two electric cutting machines. Norfolk, Va., Schedule 5947½—searchlights, switchboards and generators. Applications for proposals should designate the schedule desired by number.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Until Sept. 30, New London, Conn., Specification 3410—two subcharging stations, estimated cost $20,000. Until Sept. 23, Specification 3370—air compressors for Norfolk, Va., Philadelphia, Pa., New Orleans, La., and Charleston, W. Va., to cost about $210,000. Bids will also soon be asked for turbo-generators under specification 3352—for Indian Head, Md., Charleston, Va., Mare Island, Cal., Hampton Roads, Portsmouth, Norfolk, Va., New Orleans, La., and Philadelphia, Pa., to cost about $950,000. Cape May, N. J., Specification 3422—for fire-alarm system in Wissahickon barracks and hospital, estimated cost $7,000. Application for proposal should designate the specification desired by number.

North Central States

AKRON, OHIO.—The Public Utilities Commission has authorized the Northern Ohio Traction & Light Company to borrow $750,000 from the B. F. Goodrich Company of Akron for the construction of a high-tension transmission line from Canton to Akron, over which energy will be supplied to the Goodrich company from the plant of the Central Power Company at Windsor, W. Va.

ELYRIA, OHIO.—The Lorain County Electric Company of Elyria, which supplies energy to a number of plants engaged in war work, will enlarge its plant. The United States government through the War Industries Board has advanced $400,000 to the company to be used for extensions.

HICKSVILLE, OHIO.—The old electric plant in Hicksville is being dismantled. Under the new contract recently entered into a smaller plant, of sufficient output to maintain the Hicksville branch in case of emergency, will be installed. The North Western Ohio Light Company of Van Wert furnishes electrical service here.

SALEM, OHIO.—Equipping the waterworks pumping station with electrically driven pumps has been recommended to the Council by Service Director Connors. The purchase of a triplex pump, three deep-well pumps and a small motor-driven compressor, all to cost not more than $15,000, is favored by the service director.

SAVANNAH, OHIO.—Bonds to the amount of $10,000 have been voted for the installation of a municipal electric light plant, in Savannah, to replace the one that was destroyed by fire last April.

TOLEDO, OHIO.—A 12,500-kw. turbine at the Water Street plant of the Toledo Railways & Light Company was recently damaged by a short circuit. The loss is estimated at about $10,000.

WHITESBURG, KY.—The Elkhorn-Jellico Coal Company is considering the construction of a power plant on property recently acquired in Whitesburg.

GARY, IND.—A loan of $203,000 has been granted by the United States government to the Gary Street Railway Company and the Gary & Interurban Railroad Company. The appropriation is $170,000 for the Gary railway and $33,000 for the Gary & Interurban company.

INDIANAPOLIS, IND.—Improvements are contemplated to the local shops of the Pennsylvania Railroad at Washington Street and Jefferson Avenue, including addition to machine shops, improvements to blacksmith shop, boiler shop and the installation of an electric traveling crane, etc. The cost is estimated about $8000.

CHICAGO, ILL.—Work has started on construction of the car repair shop for the Pennsylvania lines at Fifty-ninth and Leavitt Streets, to cost about $250,000. The plans provide for the erection of ten buildings, including machine, tin and forge shops.

EAST ST. LOUIS, ILL.—A portion of the building containing the transformers at the Winstanley station of the East St. Louis & Suburban Railway Company was recently damaged by fire, caused by the explosion of an oil switch. Damage to the building is estimated at about $2,500, and the loss of the transformers is estimated at $20,000. New equipment will be purchased at once.

SADORUS, ILL.—Bonds have been voted for the installation of a municipal electric lighting system. The Council has not yet decided whether to install a generating plant or to purchase electricity.

GREEN BAY, WIS.—Plans are being prepared by Armour & Company of Chicago, for the erection of a cold storage warehouse, 75 ft. by 100 ft., at Green Bay.

MILWAUKEE, WIS. — Bonds to the amount of $200,000 are to be allowed the city of Milwaukee to provide funds for work on the municipal lighting system. The work will be carried on in the parts of the city which are now most poorly lighted.

MILWAUKEE, WIS.—Extensions and improvements are contemplated by the National Brake & Electric Company of Milwaukee, involving an expenditure of about $200,000. Plans have been completed for a new shipping and annealing building. Contracts have been awarded for an addition to casting shop, core rooms, etc. Herman J. Esser, architect, 402 Camp Building, is in charge of the work.

BELMONT, IOWA.—Plans have been prepared for the construction of a sugar factory for the Iowa Valley Sugar Company, to cost about $1,000,000.

MAQUOKETA, IOWA.—At an election to be held Sept. 24 the proposal to issue $65,000 in bonds for the installation of a municipal electric lighting plant will be submitted to the voters.

TRURO, IOWA.—The Truro Light & Power Company is reported to be in the market for 15-kw. and 25-kw., three-phase, 60-cycle, 2300-volt generators.

YORKTOWN, IOWA.—The Town Council has called an election to be held Sept. 27 to vote on the proposal to grant a franchise for the installation of an electric lighting system.

NOVINGER, MO.—The Merchants' Light & Power Company, it is reported, will rebuild its power plant, recently destroyed by fire. A 75-hp. Corliss engine will be installed.

ST. LOUIS, MO.—Contract has been awarded by the Laclede Gas Light Company for construction of a one-story munition plant, 200 ft. by 1200 ft., to the Austin Company of Cleveland, Ohio. The cost of the plant is estimated at about $8,000,000.

CLARKSON, NEB.—Bonds to the amount of $26,000 have been voted for the installation of a new power plant. New equipment, including engines, boilers, switchboard, heater, deep-well pump, etc., will be installed. The Henningson Engineering Company of Omaha, Neb., is engineer. O. A. Clarke is city electrician.

OMAHA, NEB.—Plans are being prepared by the Nebraska Power Company for an addition to its condenser house, to cost about $1800.

FRANKFORT, KAN.—Preparations are being made by the Frankfort Light & Power Company for the erection of a transmission line to the large hydroelectric plant at Blue Rapids. The local plant will be maintained for use in emergency. Copper wire for the proposed extension, it is understood, has been purchased.

SCRANTON, KAN.—The City Council is considering securing electrical service from one of the neighboring cities.

Southern States

MOUNT AIRY, N. C.—Contract has been awarded by the City Commissioners for the construction of an electric power plant, including a dam on Ararat River, 3 miles from the city, to cost about $50,000.

WILMINGTON, N. C.—Extensive improvements are contemplated by the Tidewater Power Company for increasing its transportation facilities (double-tracking its car line) between Wilmington and the shipyards and to increase the output of its plant to supply electricity to the Carolina and Liberty shipbuilding plants. About $100,000 will be expended, to be financed by the War Industries Board.

CHARLESTON, S. C.—The Charleston Consolidated Railway & Lighting Company is contemplating enlarging its power plant. The cost is estimated at about $700,000, of which $350,000 will be borrowed through the War Credits Board.

CHARLESTON, S. C.—Plans have been prepared for the construction of a naval clothing factory, replacing the present plant, to manufacture white summer uniforms and regulation underwear for the entire navy at the Charleston Navy Yard, to cost about $825,000. Two main units, under one roof, connected by a covered pasageway, will be erected; one, 400 ft. by 210 ft., section will contain a power plant, shrinking equipment, baling and shipping department, etc.; the other, 330 ft. by 266 ft., will be equipped with sewing machines, sewing tables, mess hall and kitchen, etc. Captain B. C. Bryan is commandant of Charleston Navy Yard.

COLUMBIA, S. C.—Contract has been awarded to Tucker & Laxton of Charlotte, N. C., for electrical work for additional buildings at Field Artillery Replacement Depot at Camp Jackson, at about $300,000. The cost of the buildings is estimated at $11,000,000.

ALBANY, GA. — The Albany Power & Manufacturing Company is planning to double the generating capacity of its plant. The company is now constructing a 4000-hp. hydroelectric plant and has a 70-mile transmission system and is now contemplating making connection with the system of the Columbia (Ala.) Power Company, 70 miles from Albany.

MARSHALLVILLE, GA. — The Big Indian Power Company, recently incorporated with a capital stock of $30,000, will operate a 6-mile transmission system. Equipment, it is understood, has been purchased. Gordon Simmons of Eatonton is engineer. H. A. Murphy, is manager.

TAMPA, FLA.—The Hillsboro Shipbuilding Company, recently organized, is planning to erect a shipbuilding plant to construct ships for the Emergency Fleet Corporation. The plant will be equipped with electrically operated machinery. W. H. Kendrick is vice-president and general manager.

TAMPA, FLA.—The War Department War Department, Washington, D. C., is contemplating the erection of a plant to manufacture phosphorus for screening ship and troop movements during the war, for which investigations are now being made. It is estimated that 26,000 kw. of electrical power will be required to operate the proposed plant.

CHATTANOOGA, TENN.—The Chattanooga Electro-Metals Company, recently incorporated with a capital stock of $200,000, is planning to erect a plant for the manufacture of silicon alloy, using carbon electrodes, consisting of a main building, with two smaller buildings for transformers and automatic electrodes. The proposed plant will have a daily capacity of 18 tons. G. L. Davidson is manager.

SPARKMAN, ARK.—The local electric plant, owned by Edward Hearn, is reported to have been destroyed by fire recently.

FORT PAYNE, ALA. — Bonds to the amount of $6,000 have been voted for the installation of an electric-light plant in Fort Payne.

NATCHEZ, MISS.—The installation of 500 hp. in boilers and other power equipment is reported to be under consideration by the Southern Railway & Light Company.

DUNCAN, OKLA.—Bonds to the amount of $50,000 have been voted for an addition to the power plant at the waterworks, including the installation of two 500,000-gal. per minute electrically operated pumping units. The Benham Engineering Company, Colcord Building, Oklahoma City, has charge of the engineering work.

MUSKOGEE, OKLA.—The Peabody Battery & Starter Company is planning to install additional machinery, to cost about $10,000.

AUSTIN, TEX.—The trustees of the University of Texas are planning to erect an administration building, six barracks, mess hall, all of brick construction, and four hangars in connection with the enlargement of the radio school, to cost about $600,000. Plans have been adopted for additional buildings for the School of Automobile Mechanics. Additional buildings will also probably be erected for the School of Military Aeronautics.

BROWNSVILLE, TEX.—Bonds to the amount of $350,000 have been voted for extensions to the street-lighting system, road and street work, etc.

ORANGE, TEX.—The installation of an electric power plant at its shipyard is reported to be under consideration by the National Shipbuilding Company.

Pacific and Mountain States

BREMERTON, WASH.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Sept. 30 (extension of date from Sept. 16) for improvements to power plant at the Puget Sound Navy Yard.

BREMERTON, WASH.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 15, under Schedule 1958, for generating plant, oxygen, hydrogen and electrolytic, at Puget Sound, Wash.

FILLMORE, CAL.—The Ventura Refining Company is contemplating the installation of a large electrically driven pumping plant in connection with extensive improvements to its local plant, to cost about $100,000.

LA HABRA, CAL.—Plans are under consideration by the city of La Habra for the installation of an electric street-lighting system.

LOS ANGELES, CAL.—Plans have been completed by the City Council for the construction of a new electric railway system between Redondo Beach and Torrance, about 4 miles long, to provide transportation for the workers employed in the various shipbuilding and war plants in the vicinity of San Pedro. The cost is estimated at about $100,000.

OAKDALE, CAL.—Plans are under consideration by the Waterford Irrigation District for an issue of $150,000 in bonds to provide funds for the installation of two large pumping plants, to be operated by electricity.

OROVILLE, CAL.—The Board of Trustees has petitioned the State Railroad Commission for an appraisement of the gas plant and pipes and the electric lighting distribution system owned by the Pacific Gas & Electric Company in Oroville. After appraisement has been made an election will be called to vote on a bond issue to take over the plants.

SAN DIEGO, CAL.—Work will begin about Oct. 1, by the United States government on the proposed new marine post on Dutch Flats, San Diego. The initial group, consisting of fourteen buildings, will cost about $1,500,000. The project includes electric lighting plant, waterworks, etc., to cost approximately $600,000.

OATMAN, ARIZ.—The United Eastern Mining Company is reported to be considering the installation of an emergency power plant at Oatman.

CASPER, WYO.—The plant of the Natrona County Electric Company was recently destroyed by fire, causing a loss of about $150,000. This is the second time within ten months that the plant has been destroyed by fire.

Canada

LACOMBE, ALTA.—The installation of an engine at the municipal electric light plant, to cost about $8,000, is under consideration. N. E. Caruthers is manager.

PORTAGE LA PRAIRIE, MAN.—The City Council is planning to erect an electric transmission line to supply electricity to operate the municipal electric plant. The cost is estimated at about $325,000. R. Pride is engineer.

CHIPPEWA, ONT.—The installation of an electric plant, to cost $6,500, in Chippewa is under consideration.

QUEBEC, QUE.—Plans are being prepared by the Quebec Railway, Light & Power Company for the extension of its street-car line along the Beauport Road, from Limoilou to the city limits.

Miscellaneous

SANTA ROSALIA, MEXICO—Preparations, it is reported are being made by the Mexico Northern Power Company of Santa Rosalia to resume construction work on its hydroelectric plant on the Conchos River More than $2,000,000 has been expended in the construction of a dam across the river. The installation of an electric power plant and the erection of electric transmission lines to the different cities and mining districts within a radius of 150 miles of Santa Rosalia will require an additional $3,000,000. Besides the hydroelectric power development and distribution system, it is proposed to reclaim about 200,000 acres of land by irrigation in the valley of the Conchos River.

1,275,572. ELECTROMAGNETIC STRUCTURE; Albion D. T. Libby, East Orange, and Edward J. Tomlinson, Newark, N. J. App. filed Nov. 11, 1916. Especially adapted for use in connection with the operation of a generator used on a variable-speed engine such as is used in auto-vehicles.

1,275,577. POWER PLANT; Otis K. Luscomb, Allston, Mass. App. filed Dec. 31, 1917. For use in automobiles and other restricted places; applies more particularly to a power plant comprising both mechanical and electrical parts.

1,275,585. MEANS AND APPARATUS FOR EXTRACTING STATIC ELECTRICITY; John H. Morgan and Charles W. Huntley, Holyoke, Mass. App. filed Feb. 25, 1915. Improvements.

1,275,586. SYSTEM FOR CHARGING CAR-LIGHTING BATTERIES; Thomas L. Mount, New York, N. Y. App. filed June 23, 1917. Provides means that automatically disconnect the battery from the charging mains when it becomes fully charged.

1,275,601. CURRENT-RECTIFYING COMMUTATOR; Frederick W. Reeves, Pittsburgh, Pa. App. filed Aug. 23, 1917. To provide a simple and practical means whereby the assembled bars interlock to prevent displacement of one or more of the bars.

1,275,606. ELECTRIC CLOCK; Thomas Rushton, Tollington Park, London, Eng. App. filed April 18, 1914. An electromagnetic driving and contact mechanism, including a longitudinally movable worm subjected to end pressure, adapted to rotate the clock train, and itself to be rotated by electromagnetic means, and controlling by its longitudinal movement the electric circuit of the apparatus.

1,275,625. AUTOMOBILE-LIGHT CONTROLLER; Howard F. Bucklew, Kingwood, W. Va. App. filed March 16, 1917. To be used upon automobiles in connection with a magneto or generator for supplying electrical current for the headlights.

1,275,631. DEVICE FOR TRANSMITTING FLUCTUATIONS IN THE VOLTAGE OR CURRENT OF AN ALTERNATING-CURRENT SYSTEM TO ELECTRORESPONSIVE OR MAGNETICALLY OPERATED DEVICES; Prof. Gerardus J. van Swaay, Delft, and Henri I. Keus, Hengelo, Netherlands. App. filed Jan. 23, 1915. Any fluctuations in the voltage of current of an alternating-current system cause considerably stronger fluctuations in the operation of the device.

1,275,657. ELECTRICALLY OPERATING PRINTING DEVICE; Arthur P. Bullock, Cleveland, Ohio. App. filed April 24, 1913. For automatically causing the selection of printing elements according to a predetermined relationship.

1,275,665. DYNAMO-ELECTRIC MACHINE; Herman W. Eichbaum, Venice Cal. App. filed June 25, 1917. To provide an electric machine which may be compactly designed and provided with means whereby its capacity may be increased or decreased in a convenient manner.

1,275,687 ELECTRICAL CONNECTION AND ART OF MAKING THE SAME; Wilfred D. Hodgson, Akron, Ohio. App. filed May 16, 1917. Cheap and compact, yet durable, reliable and efficient metallic conducting circuits.

1,275,690. FLUSH RECEPTACLE; Harvey Hubbell, Bridgeport, Conn. App. filed June 17, 1915. To provide a device comprising a body, a top block and a base or adjustment plate which shall be so constructed that the top block may be removed without disturbing the base or adjustment plate.

1,275,691. MEANS FOR LEVELING AND ALIGNING FACE PLATES; Harvey Hubbell, Bridgeport, Conn. App. filed Nov. 17, 1915. To provide simple and inexpensive means for leveling the fixtures in the wall pockets and for aligning the face plates without tentative adjustments.

1,275,692. ADJUSTABLE SUPPORTING DEVICE FOR SWITCHES AND RECEPTACLES; Harvey Hubbell, Bridgeport, Conn. App. filed June 22, 1917. To provide an adjusting device which is sold with the switch or receptacle, is attached to the outlet box and provides a rigid support for the switch or receptacle, parallel with the plaster line and without regard to the position of the outlet box.

1,275,693 CONVERTIBLE CAP FOR ATTACHMENT PLUGS; Harvey Hubbell, Bridgeport, Conn. App. filed Dec. 17, 1917. So constructed that one or both of the contact blades may be readily removed and shifted from one position to another.

1,275,703. CONVERTIBLE CAP FOR ATTACHMENT PLUGS; George P. Knapp, Bridgeport, Conn. App. filed Dec. 5, 1917. Provided with floating contact blades adapted to be moved from one position to another without detachment from the body.

Record of Electrical Patents

Notes on United States Patents

1,275,725. ADJUSTER FOR ELECTRICAL ATTACHMENTS; William J. Newton, Bridgeport, Conn. App. filed June 22, 1917. To provide an adjusting device intermediate of the switch or receptacle and the outlet box which will provide a rigid support for the switch parallel with the plaster line and without regard to the position of the outlet box.

1,275,726. SURFACE TOGGLE SWITCH; William J. Newton, Bridgeport, Conn. App. filed Aug. 11, 1917. Improves the construction and mode of operation of surface toggle switches.

1,275,766. COMBINED ELECTROMAGNETICALLY AND MANUALLY OPERABLE ORGAN STOP KEY; Fred Schoenwolf, Chicago, Ill. App. filed Oct. 6, 1915. Combined structure including a manually operated stop key which may be operated by means of a solenoid electromagnet.

1,275,776. TELEPHONE TRANSMITTER; Johan Skinderviken, Chicago, Ill. App. filed Nov. 7, 1917. Improvements.

1,275,777. HOUSING FOR ELECTRICAL APPLIANCES; Elda G. Smith and John J. Dossert, Syracuse, N. Y. App. filed June 18, 1914. For housing a telephone jack used in connection with railway cars.

1,275,780. ELECTRIC CONTROLLER; Edgar A. Spurr, Euclid, Ohio. App. filed June 5, 1914. Motor is automatically brought up to speed in accordance with the current in the motor circuit.

1,275,782. ALTERNATING-CURRENT RECTIFIER; Charles P. Steinmetz; Schenectady, N. Y. App. filed Aug. 24, 1914. To provide a method of and means for rectifying alternating currents of higher potential than can conveniently be rectified by commercial forms of rectifiers in use at the present time.

1,275,785. RESISTANCE UNIT; Harry F. Stratton, Cleveland, Ohio. App. filed Nov. 9, 1915. For motor starting, heating, etc., relating particularly to what is known as unit-type resistance.

1,275,786. OHM METER; Harry G. Stuart, Paterson, N. J. App. filed Feb. 24, 1917. Direct-reading.

1,275,796. ELECTRICAL REGULATOR; Allen A. Tirrill, Pittsburgh, Pa. App. filed Oct. 5, 1911. To provide a simple and exceptionally effective regulator of the kind in which the regulation is effected by adjustment of the field excitation of a dynamo-electric machine.

1,275,802. ELECTRIC SIGNALING APPARATUS; John J. Ghegan, East Orange, N. J. App. filed Dec. 20, 1916. To substitute the alternating current from a main supply circuit for the local batteries heretofore employed.

1,275,814. THERMAL SWITCH; George Wilkinson, Harrowgate, Eng. App. filed Nov. 24, 1915. For use as thermostats in which the expansion and contraction of mercury or other fluid, due to heat and cold, is employed to "make" and "break" electric circuits.

1,275,811. SYSTEM OF CONTROL; Charles C. Whittaker, Wilkinsburg, Pa. App. filed May 27, 1916. A rheostat of the type which shall embody means independent of the electrolyte for varying the effective resistance of the rheostat under predetermined conditions.

1,275,817. ELECTROMAGNETIC SWITCH; J. J. Wood, Fort Wayne, Ind. App. filed Nov. 20, 1914. Will effect the automatic starting of the motor under the control of the motor current.

1,275,820. INCANDESCENT LAMP; Francis M. A. Wybaillie, New York, N. Y. App. filed Jan. 26, 1917. Adapted to be used in series.

1,275,844. ELECTROMAGNETIC SWITCH; Eugene R. Carichoff, Schenectady, N. Y. App. filed Sept. 25, 1916. Holds open when the current in a circuit is relatively high and closes when the current drops to a predetermined value.

1,275,845. ELECTROMAGNETIC SWITCH; Eugene R. Carichoff, Schenectady, N. Y. App. filed Sept. 25, 1916. To employ a plurality of electromagnetic switches which close successively to cut out sections of resistance from the motor circuit and bring the motor up to speed.

1,275,846. SWITCH STRUCTURE; Frank E. Case, Schenectady, N. Y. App. filed Dec. 14, 1917. Switches may be efficiently and economically assembled or repaired.

1,275,879. ELECTROMAGNETIC SWITCH; John Eaton, Schenectady, N. Y. App. filed May 2, 1916. For controlling the circuits of electric motors; applies more particularly to improved means whereby an electric motor may be started and automatically brought up to running speed.

1,275,880. CONTROL SYSTEM FOR ELECTRIC MOTORS; John Eaton, Schenectady, N. Y. App. filed May 11, 1915. Provision of means whereby the motor may be started, stopped and generally controlled in a reliable and efficient manner.

1,275,886. ARC-CONTROLLING MEANS FOR VAPOR CONVERTERS; Sidney W. Farnsworth, Pittsburgh, Pa. App. filed Aug. 6, 1915. To provide means that shall maintain arc in a stable condition upon either the anode or the cathode or upon electrodes of both polarities, if so desired.

1,275,901. MAGNETO MACHINE; Harry F. Geist, Racine, Wis. App. filed May 20, 1916. Relates to dynamo-electric machines capable of being used for ignition purposes in association with internal combustion engines.

1,275,903. ELECTRIC SIGNALING APPARATUS; John J. Ghegan, East Orange, N. J. App. filed April 12, 1917. Will operate on an alternating-current circuit, as, for instance, the sixty-cycle alternating current commonly supplied for lighting and power purposes.

1,275,908. LIQUID RHEOSTAT; Arthur J. Hall, Wilkinsburg, Pa. App. filed Feb. 17, 1915. Employed for the purpose of governing the acceleration of railway polyphase induction motors.

1,275,909. MOTOR-CONTROL SYSTEM; Jay H. Hall, Cleveland, Ohio. App. filed Dec. 7, 1917. For motors having shunt-wound fields, in which the speed of the motor may be increased or decreased at will by varying the field strength.

1,275,916. DYNAMO-ELECTRIC MACHINE; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed June 4, 1915. Machines of the commutator type which are provided with commutating field-magnet windings carried by auxiliary polar projections disposed intermediate the main polar projections for the purpose of improving the commutating conditions during the operation of such machines.

1,275,918. SWITCH; Edward M. Hewlett, Schenectady, N. Y. App. filed May 9, 1914. For very high voltages.

1,275,919. DISCONNECTING SWITCH; Edward M. Hewlett, Schenectady, N. Y. App. filed Dec. 15, 1914. Quick-acting, rugged, easy to operate and positive in its action.

1,275,924. ELECTRIC LOCOMOTIVE; Fred B. Howell, Schenectady, N. Y. App. filed April 20, 1918. To provide an improved universal joint of simple and rugged construction.

1,275,939. SPRING CLIP FOR STORAGE BATTERIES; Charles H. Kay, Los Angeles, and Charles F. Hartung, Alhambra, Cal. App. filed Dec. 11, 1917. Means for quickly making temporary electrical connections for the purpose of testing.

1,275,940. STARTING APPARATUS FOR INTERNAL-COMBUSTION ENGINES; August Kazenmaier and Eugene Bauer, Stuttgart, Germany. App. filed March 6, 1914. Improvements.

1,275,941. STARTING APPARATUS FOR INTERNAL-COMBUSTION ENGINES; August Kazenmaier and Eugene Bauer, Stuttgart, Germany. App. filed March 6, 1914. For preliminarily rotating a rotatable element.

1,275,945. SWITCHING DEVICE; Benjamin G. Lamme, Pittsburgh, Pa. App. filed Aug. 2, 1913. To provide simple automatic means whereby the switch controlling the polarity of the direct-current line that is supplied from a rotary converter or the like shall always be closed to the correct position, irrespective of the relative polarity of the machine terminals.

1,275,946. HIGH-REACTANCE CORE-TYPE TRANSFORMER; Charles S. Lawson, Pittsburgh, Pa. App. filed April 4, 1916. To secure high internal reactances in order to limit to safe values the currents that may flow through the windings of the transformers when they are subjected to short circuits.